

TABLE OF CONTENTS

PROJECT AND PARTICIPANTS

Administrative Advisor and TAC	2
U. S. Department of Agriculture	2
Western Regional Plant Introduction Station, Pullman, WA	3
National Forage Legume Genetic Resource Unit, Prosser, WA	3
National Arid Land Plant Genetic Resource Unit, Parlier, CA	3
National Arctic Plant Genetic Resource Unit, Palmer, AK	3
Other Support Personnel	4

EXECUTIVE SUMMARY	5
Germplasm: Summary of Activity	6
Personnel	6
Visitors to the station	6

REPORTS BY PROJECT

Administration (R. Hannan, V. Lutes)	8
Curatorial and Research	
Agronomic, Grass and Safflower (V. Bradley, B. Geunthner)	11
Cool Season Food Legumes (C. Coyne, M. Cashman)	13
Horticultural Crops (B. Hellier, R. Staska)	17
Beets (A. Hodgdon)	20
<i>Phaseolus</i> (M. Welsh, J. Thayer, R. Yarborough)	21
Entomology (S. Clement, L. Elberson)	24
Plant Pathology (F. Dugan, S. Lupien)	29
Agronomy (R. Johnson, C. Foiles)	36
Molecular Genetics Laboratory (T. Kisha)	47
Program Operations and Support	
Computers and Safety (G. Pentecost)	50
Seed Storage and Germination Laboratory (D. Stout, P. Lundt, M. Nelson)	53
Pullman Farm Operations (W. Olson, S. McGee)	55
Seed Cleaning (D. Cervantes)	59
Central Ferry Farm Operations (K. Tetrick)	61
Greenhouse Operations (W. Luna)	63
National Forage Legume Genetic Resource Unit, Prosser, WA (S. Greene)	66
National Arid Land Plant Genetic Resource Unit, Parlier, CA (M. Jenderek)	69
National Arctic Plant Genetic Resource Unit, Palmer, AK	
Plant Pathology (N. Robertson)	72
Arctic Germplasm (D. Ianson)	75

APPENDICES

Appendix A (Publications)	78
Appendix B (W-6 TAC Minutes)	83

PROJECT AND PARTICIPANTS

PROJECT TITLE: W-6 Plant Genetic Resource Conservation and Utilization

COOPERATING AGENCIES AND PRINCIPAL LEADERS:

Administrative Advisor

Ralph Cavalieri

Regional Coordinator

Richard Hannan

State Experiment Station Representatives

Alaska	Stoney Wright	Montana	Jack Martin
Arizona	Steve Smith	New Mexico	Ian Ray
California	Dan Parfitt	Oregon	Shawn Mehlenbacher
Colorado	Mark Brick	Utah	Kevin Jensen
Hawaii	no rep	Washington	Tom Lumpkin
Idaho	Bob Zemetra	Wyoming	Robin Groose

U. S. Department of Agriculture

National Clonal Germplasm Repository, Corvallis, OR Kim Hummer

National Clonal Germplasm Repository for Citrus and Dates, Riverside, CA
Robert Kreuger

National Clonal Germplasm Repository for Tree Fruit/Nut Crops and Grapes, Davis CA
Chuck Simon

National Small Grains Collection (NSGC), Aberdeen, ID Harold Bockelman

ARS National Program Staff

Peter Bretting

ARS Plant Exchange Office

Edward Garvey

ARS Pacific West Area Director

Antoinette Betchart

Natural Resources Conservation Service

Mark Stannard

National Center for Agricultural Util. Research

Tom Abbott

National Center for Genetic Resources Preservation

Henry Shands

REGIONAL PROJECT W-6: Plant Genetic Resource Conservation and Utilization, 2001
WESTERN REGIONAL PLANT INTRODUCTION STATION

Research Leader/Station Coordinator	ARS	Dr. Richard Hannan	
Program Assistant	ARS	Ms. Vickie Lutes	
Information Tech/Collateral Duty Safety Officer	ARS	Ms. Gwen Pentecost	
Seed Manager/Data Specialist	ARS	Mr. Dave Stout	
Seed Storage Technician	WSU	Ms. Paula Lundt	
Facilities and Farm Manager (Pullman)	WSU	Mr. Wayne Olson	
Plant Technician II	WSU	Mr. Scott McGee	
Plant Technician II (Seed Processing)	WSU	Mr. Dan Cervantes	
Facilities and Farm Manager (Central Ferry)	ARS	Mr. Kurt Tetrick	
Research Entomologist	ARS	Dr. Stephen Clement	
Biological Technician	ARS	Leslie Elbersen	
Research Plant Pathologist	ARS	Dr. Frank Dugan	
Biological Technician	ARS	Ms. Shari Lupien	
Research Agronomist	ARS	Dr. Richard Johnson	
Geneticist	ARS	Dr. Theodore Kisha	
Biological Technician	ARS	Ms. Connie Foiles	
Agronomy Curator	ARS	Ms. Vicki Bradley	
Biological Technician	ARS	Mr. Bob Guenther	
Horticulture Crops Curator	ARS	Ms. Barbara Hellier	
Biological Technican	WSU	Mr. Russell Staska	
Biological Technician	ARS	Mr. William Luna	
<i>Phaseolus</i> Curator	ARS	Dr. Molly Welsh	
Plant Technician II	WSU	Ms. Julie Thayer	
Cool Season Food Legume Curator	ARS	Dr. Clare Coyne	
Biological Technician	ARS	Mr. Michael Cashman	
<i>Beta</i> Curator	ARS	Dr. Alan Hodgdon	
National Forage Legume Genetic Resource Unit, Prosser, WA			
Forage Legume Curator, Prosser, WA	ARS	Dr. Stephanie Greene	
Biological Technician, Prosser, WA	ARS	Mr. Andrew Bell	
Biological Technician , Prosser, WA	ARS	Ms. Estela Cervantes	
National Arid Land Plant Genetic Resource Unit, Parlier, CA			
Horticulturist/Curator, Parlier, CA	ARS	Dr. Maria Jenderek	
Biological Technician, Parlier, CA	ARS	Ms. Abigail Rosales	
Biological Technician, Parlier CA	ARS	Mr. Jerry Serimian	
Biological Science Aid, Parlier, CA	ARS	Mrs. Carmen Zeneno	
National Arctic Plant Genetic Resource Unit, Palmer, AK			
Research Plant Pathologist, Palmer, AK	ARS	Dr. Nancy Robertson	Reassigned to PWA
Biological Technician, Palmer, AK	ARS	Kathryn Brown	Reassigned to PWA
Biological Technician, Palmer, AK	ARS	Casey Hessinger	Reassigned to PWA
Arctic Germplasm Curator, Palmer, AK	ARS	Dr. Dave Ianson	Reassigned to PWA
Agronomist, Palmer, AK	AK	Ms. Gretchen Rector	Reassigned to PWA
Technician, Palmer, AK	AK	Ms. Chris McCallister	Reassigned to PWA

OTHER SUPPORT PERSONNEL

Employee	Supervisor	Status
Bailey, Margo	Molly Welsh	Service Worker
Bonnett, Jeff	Alan Hodgdon	Service Worker
Brumfield, Airica	Paula Lundt	Service Worker
Clinton, Troy	Wayne Olson	Farm Crew
Cochran, Judy	William Luna	Greenhouse Worker
Craven, Holly	Clare Coyne	Tech. Asst.
Doggett, Chris	Connie Foiles	Service Worker
Fabre, Rena	Ted Kisha	Tech. Asst.
Flores, Normangelia	Drew Bell	Service Worker
Flores, Sofia	Stephanie Greene	Service Worker
Foxe, David	Paula Lundt	Service Worker
Haskins, Samantha	Connie Foiles	Service Worker
Hewitt, Anna	Connie Foiles	Service Worker
Johnson, Laurie	Clare Coyne	Service Worker
Johnston, Miriam	Clare Coyne	Service Worker
Jurgensen, Jennifer	Clare Coyne	Service Worker
Kelly, Joyce	Connie Foiles	Service Worker
Krebs, Jessica	Wayne Olson	Service Worker
Law, Andrew	Alan Hodgdon	Service Worker
Lutes, Ann	Ted Kisha	Tech. Asst. I
McClendon, Melissa	Clare Coyne	Grad Student
Miller, Zachary	Wayne Olson	Service Worker
Mon, Pon Nya	Wayne Olson	Service Worker
Morgan, Brandon	Kurt Tetrick	Service Worker
Nelson, Marge	Dave Stout	Seed Technician
Newman, Vicki	Rich Hannan	Grad Student
Nix, Joshua	Wayne Olson	Service Worker
Nolan, Lisa	Connie Foiles	Service Worker
Olson, Steve	Connie Foiles	Service Worker
Pavelka, Marie	Barbara Hellier	Service Worker
Peppel, Duane	Wayne Olson	Service Worker
Phillips, Frank	Kurt Tetrick	Service Worker
Price, Lacey	Wayne Olson	Service Worker
Rathke, Renee	Bob Guenther	Service Worker
Razai, Leon	Clare Coyne	Service Worker
Rosales, Abigail	Jerry Serimian	Bio. Sci. Aide
Sapp, Joseph	Wayne Olson	Service Worker
Saufferer, Sandra	Rich Hannan	Botanist
Schachner, Lauren	Paula Lundt	Service Worker
Sitton, Jerry	Frank Dugan	Professional Worker
Valencia, Pablo	Drew Bell	Service Worker
Vincent, Tracy	Clare Coyne	Service Worker
White, Erica	Wayne Olson	Service Worker
Williams, Kristine	Steve Clement	Service Worker
Yarborough, Robert	Molly Welsh	Tech. Asst. II
Yowell, Rebecca	Wayne Olson	Service Worker

EXECUTIVE SUMMARY, (R. Hannan)

Agriculture in the United States is primarily based upon crop plants which are native to other

parts of the world. The research of this unit is consistent with the stated mission of acquisition, preservation, evaluation, and use of plant germplasm for the benefit of U. S. agriculture. We utilize current technologies and information to best achieve germplasm conservation goals. The group is comprised of scientists in the disciplines of agronomy, horticulture, entomology, plant pathology, genetics, botany and natural resource management. At year's end the four W-6 sites were responsible for 2,517 taxa in 358 genera (22% of NPGS total). We maintain 70,788 accessions. We had a total of 682 accessions in 45 genera added to the W-6 collections from plant explorations, germplasm exchanges, and from the NSSL. In 595 orders, 11,589 accessions were distributed (68% domestic, 32% foreign) in 17,072 packets. A total of 693 accessions were sent to NSSL for long-term back-up storage.

In addition to increasing low quantity and/or low germination accessions, collecting and providing quality information and data has been a top priority for all curators. A number of special projects have focused on the genetics of conserving germplasm populations. We continued collaborative studies to reduce genetic drift in heterogenetic accessions by determining the effective population size and to maximize efficiency in the harvesting process. We are using molecular markers to genotype germplasm collections for diversity analysis and accession duplication. This is being done on a number of important crops (alfalfa, beans, peas and grasses) in Pullman collections. A project to reorganize the *Cicer* core collection was established to include new W6 material since development of the first core. Work began on an *Allium ampeloprasum* pollinator density trial. A 3-year study to quantify populations of aphid pests on perennial grasses in replicated plots at Central Ferry was completed, as well as a series of greenhouse experiments to evaluate tall fescue for resistance to rose grass aphid. Since burning of Kentucky bluegrass during seed production fields is increasingly restricted, new germplasm to improve yield under non-thermal management is being evaluated. Work to address questions regarding variation within accessions will produce enhanced germplasm from the bluegrass collection for research and industry use. Started comparison of harvest methods in grass regeneration plots. Molecular characterization of three seed lots of the slender wheatgrass variety 'Primar' was initiated. Filamentous fungi quiescent in seeds and culm nodes of weedy and forage grass species endemic to the Palouse region of Washington and Idaho were surveyed. Morphological and cultural differentiation of described species of *Alternaria* from Poaceae was determined. It was found that the *Neotyphodium* endophyte of wild barley, grows and sporulates on leaf surfaces of the host, and a series of experiments were initiated to examine the susceptibility of endophyte-infected Barley accessions to Hessian fly development of seed rescue/special care regeneration capacity. Although the regeneration capacity of this project has increased substantially since 1994, our efforts have focused on increasing accessions that have sufficient quantities of viable seed to be handled in a routine, cost effective manner. Initiated a follow-up investigation of alfalfa relatives collected in Kazakhstan in 2000. The focus of this project is to better understand the genetic relatedness and ecological significance among parental and hybrid populations of wild alfalfa that persist naturally in the environment.

Germplasm: Summary of Activity

At year's end W-6 was responsible for 2,517 taxa in 358 genera (22% of the NPGS) with a total of 70,788 accessions. In 2001, we received 330 new accessions from collections, plant

explorations and germplasm exchanges. We also received 342 accessions from the National Seed Storage Laboratory, Ft. Collins, CO for inclusion into our Pullman collections and 10 accessions were transferred from other sites. Therefore, we had a total of 682 accessions in 45 genera added to the W-6 collections.

During the year, 11,589 accessions were distributed in 17072 packets. There were 595 separate orders filled, and of these, 407 (68%) were domestic and 188 (32%) were sent to foreign scientists. Within the 105 genera distributed, there were 924 taxa represented in the 17,072 packets sent. Within the Western Region alone, there were 15,661 accessions received by users of germplasm. Of this 33% was provided by the Western Regional Plant Introduction Station.

By the end of CY2001 the number of PI accessions (51,664) backed up at NCGRP increased to 73% of our collection. During the year, a total of 693 accessions were sent to NCGRP for back-up. The goal continued to be getting back-up samples of all of the accessions which are so difficult to propagate. As yet, we have not had the resources to implement an ongoing tissue culture/ cryogenic program at the Pullman location, but will continue coordinating with the cryogenic laboratory at NCGRP.

Personnel

- June Martha "Estela" Cervantes was hired on a full-time, permanent Biological Science Technician for the National Foreage Legume Genetic Resource Unit in Prosser, Washington.
- July Nancy Robertson, Dave Ianson, Casey Hessinger and Kathryn Brown of Palmer, Alaska, were reassigned to the Area Office temporarily until it is established as an official location.

Visitors to the Station

- Jan 18 Dr. Marie-Laurie Pilet, from France to present results of her post-doc. Presented a seminar entitled, "antititative trait loci mapping for aphanomyces root rot resistance in pea."
- Mar. 3 Massiors Cristofaro of the Biotechnology de Bio Central Agency in Rome, Italy.
- Mar. 25 Dr. Gowsela Sivam and five students from Bastyr University, Research Institute visited to tour the WRPIS facility.
- Apr. 4-6 Dr. David Ianson and Ms. Gretchen Rector, from the National Arctic Plant Genetic Resource Unit, Palmer, AK visited Barbara Hellier to get rhubarb germplasm to take back to Alaska.
- Apr. 9 Mun Yong Ha, Head Researcher, Veterinary Institute of Ryongmun-Dong Daesang District, Pyongyang. D.P.R.K.
Ryu Hui Chang, Director, Poultry Engineering Research Institute of Sangdang - Dong Hyongjesan District, Pyang yang. D.P.R.K.
Ri Song Jo, Ministry of Agriculture, Vice Director of Agriculture Production Department. Chungsong - Dong Central District, Pyongyang. D.P.R.K.

- Tong Kyong Chol, Korean Committee for Solidarity with World People,
Yonggwang St. 2 Central District, Pyongyang. D.P.R.K.
Kang Song Nam, Manager Sariwon Pig Farm, Chongbang - Dong Sariwon N.
Hwanghae Prov., D.P.R.K.
- May 10-12 Armen Kakchachatryan, First Deputy Minister of Agriculture. Dr. Levon Rukhkyan, Chif of Science and Education Ministry of Agriculture. Dr. Ashot Charcyhoglian, Director of Institute of Botany. Dr. Samvel Gasparian, Viticulture. From Yerevan, Armenia.
- May 20-24 By special invitation, Dr. Robert Webster, NPGS, GIS specialist came to educate and train WRPIS scientists who are interested in adapting GIS technology into germplasm conservation programs.
- Jun. 20 Chinburen, Ungpau, C. Neumudcyan, and D. Yoroo of Mongolia.
- Jun. 21 Guodong Han, Inner Mongolia Agricultural University, China.
Ze hui Bhi, Institute of Grassland Science, Sichuan, Yi Jim, China.
He Yi, Animal Nutrition Institute of Gansu Province, China.
Gu Onlin, Grassland Research Institute, Chinese Academy of Agricultural Sciences, Huhhot, Inner Mongolia, China.
Kevin Connors, Plant Pathologist, USDA-ARS, Forage and Range Research Lab, Logan, Utah.
- Jul. 20 Robert Clyde, Latah Alternative Crop Cooperative, 3060 Hwy. 95 South, Moscow, Idaho 83843.
- Jul. 28-30 Yue hua Chen, Institute of Industrial Crops, Urumoi, China
Zhao mu Wang, Institute of Industrial Crops, Urumoi, China
Zongwen Zhang, IPGRI Office for East Asia, Beijing, China
Nicholas G.A. Wachsmann, University of Melbourne, Horsham, Australia
Susan E. Knights, University of Melbourne, Horsham, Australia
Du Lijie, China Xinjiang Ta-yuan Safflower Co., Urumoi, Xinjiang, China
Li Dajue, Beijing Botanical Garden, Beijing, China
Toured the station after the safflower conference.
- Aug. 6 Lynn D. Holappa, WSU alumni, Transgenomic Inc., San Jose, California.
- Aug. 20 Nalini Malli Kaejura, ICRISAT - Genetic Resources and Enhancement Division, India.
- Aug. 21 Dave Carmean, Simon Fraser University, B.C. Canada.
- Sept. 26 Dr. Joseph Jen, USDA, Under Secretary for Cooperative State Research, Education, and Economics from Washington DC visited our facility.

REPORTS BY PROJECT

ADMINISTRATION (R. Hannan, V. Lutes)

As both the Regional Project and ARS CRIS Projects are due to be rewritten this year, we are developing comprehensive set of medium and long range goals for both germplasm conservation and research projects related to the conservation efforts. It only remains to put this all in the framework of the new guidelines for project renewals. Relative to the Parlier and Palmer sites,

2001 was a very productive year for the former and a development year for the latter. At Parlier, 1,441 accessions were grown. This included material from three Regional Stations, the Small Grains Collection, the National Seed Storage Lab, and the Clonal Repository in Corvallis. At Palmer, material was grown for two PI stations, but the primary increases were of new species for the Arctic Plant Germplasm Unit. With regard to priority site designations and moving actual germplasm collections, I worked closely with other RLs in the NPGS to develop more logical placement of some of the collections. In this regard I am serving on a special subcommittee of the NPGS, Plant Germplasm Operations Committee to address issues of germplasm acquisition and distribution. There are some very significant issues, such as long term preservation of GMO germplasm, that we must address in a preemptive way. In addition, we at WRPIS are interested in incorporating the use of GIS technology into our germplasm management protocols, and we organized a workshop where we brought in the NPGS GIS expert, Dr. Robert Webster, from Beltsville and had a three day workshop for our scientists. I was requested by the Northern Plains Area Director to serve as the only ARS panelist on an external program review of the USDA, ARS, National Seed Storage Laboratory, Ft. Collins, CO in February. This was both an informative and educational process and we look forward to a project review of our station in some future year.

With regard to fiscal management, the most significant accomplishment was that we closed out the fiscal year within one hundredth of one percent of a balanced budget. With a \$2.4M budget (this does not include Palmer, AK) we closed out the year with about a \$1,400 balance. This was done by planning and projecting early in the year and not by heavy year end spending. The Palmer, AK project was removed from the Pullman Management Unit (MU) in August of 2001. Even though I was relieved of overall supervisory and management duties of the Palmer site, I was assigned, for the sake of continuity, fiscal oversight until the end of FY01. In this role, I assisted Drs. Robertson and Ianson in August and September such that the new money allocated in FY01 that was not used for a new SY was utilized effectively and pragmatically. I also organized the supplemental grant to complete the screenhouse construction at the Palmer PMC, and helped prioritize and coordinate purchases in order to effectively use the CRIS funds partitioned to the SCA with AK.

As always, safety for our workers and the surrounding environment are of utmost importance to me as a supervisor and a worker. In a program the size of this MU, the required percentage of NTL funds for R&M is fairly accurate, and in 2001 we used those resources for a significant amount of safety and facility upgrades. Examples include new safety gear for greenhouse/screenhouse and field pesticide applications, tractor modifications, seed cleaning equipment upgrades, an air filtration system for the seed cleaning facility, and the completion of the construction of a building to serve as the central hub for our greenhouse/screenhouse facilities. In this regard, 2001 was an active year working with the PWA engineers on construction projects at all four sites. We also acted on the 'security assessment' that we independently had done by a unit of the WSU Police Department and upgraded locks, revised our MU security protocols, and then implemented these new rules.

We have completed the multi state garlic experiment, and the data is in Wisconsin being compiled by Dr. Phil Simon, USDA, ARS. I was invited to and presented the garlic storage data

at an international symposium held in Tulsa, OK in October. The manuscript for this work is still in preparation. Collaborative work on cryogenic storage of clonal *Allium* germplasm with the National Seed Storage Laboratory (Dr. Gayle Volk) and Barbara Hellier, Hort Crops Curator, WRPIS, is still in progress, and includes both hypothesis testing research as well as immediate application of previous research done by one of my graduate students here at WSU. I was involved in the conception, planning and data assessment of a research project on culinary sage production completed by another graduate student, Vickie Newman, who completed her MS degree in June. As a result of being invited to evaluate the National Armenian Germplasm System, I wrote the proposal and was awarded the funds (\$10,000) to conduct the first plant exploration trip by USDA in Armenia that has been taken in many years. As the only USDA scientist on this expedition (Aug. 5-25) and one of two US participants, we increased the USDA holdings of germplasm from Armenia by 550 accessions from the previous 180. More importantly, we collected samples in many genera that had not previously been collected, and added accessions of entirely new species to the USDA, NPGS collection.

Talks and Presentations for R. Hannan

- Mar. 25 Presented NPGS and the WRPIS programs to Dr. Gowsela Sivam and five students from Bastyr University, Bothell, WA.
- Jun. 27 Presentation to the combined Regional Technical Advisory Committee Meeting and the NPGS, Plant Germplasm Operations Committee Meeting. Presented proposal for National GIS component in NPGS at combined RTAC and PGOC meeting.
- Oct. 31 Symposium Lecture, ‘Storage times for garlic using conventional storage’, Garlic is Life Symposium. Tulsa, OK.
- Nov. Invited to speak at the annual meeting of the National Association of Botanical Gardens, Boston, MA. Declined due to budget and time constraints.

Travel, Invitations, Special Awards and/or Assignments for Hannan or as indicated.

- Jan. 25-27 Attended and participated as Chair of the Desert Legume Program Board of Advisors, Tucson, AZ.
- Jan. Received invitation and offer of funding from the government of Peoples Republic of China for plant germplasm and scientific exchange with scientists in Guixou Province. 2001. Declined due to time constraints.
- Feb. 7-9 To Palmer, AK to work with the NAPGRU on program development.
- Feb. 13-15 To NALPGRU, Parlier, CA for program review and work.
- Feb. 13-15 Vickie Lutes attended training in the use of the VersaPath, the new USDA-ARS travel program in Albany, CA.
- Feb. 25-
Mar. 2 Invited by Area Director, NPA, to participate as the only ARS panelist in the external program review of the National Seed Storage Laboratory and National Animal Germplasm Program. Fort Collins, CO.
- May 7-9 Participated as a technical advisor on the National Clonal Germplasm Repository Technical Advisory Committee, Corvallis, OR.

- Jun. 25-29 Attended and participated in the W6-TAC, PGO, and Sorghum Meetings, Ft. Collins, CO.
- Aug. 5-25 As Principal Investigator and author of proposal, received funding and support from both USDA, ARS, NPGS Plant Exploration Office, and USDA, Marketing Assistance Program, Armenia, for plant exploration in Armenia to collect plant germplasm of food legumes, forage legumes, grasses, ornamentals, vegetables and fruits. Was head of party for the exploration.
- Sep. 18 To Pasco, WA to work with Dr. E. Sorenson on publication of Extension Bulletin and then to Prosser, WA to work with Dr. S. Greene, NFLGRU.
- Oct. 30- Attended and participated in the Symposium Series at the Garlic is Life
Nov. 2 Symposium and Festival, Tulsa, OK.
- Dec. 10-13 To NALPGRU, Parlier, CA for program review and work.

Committees, Other Assignments, Activities, and News

Advisory Board to the Desert Legume Program (DELEP), Tucson, AZ, (Chair 2000-03)
 WSU, Graduate School Representative for Ph.D. and MS defenses
 WSU, Adjunct Faculty, Department of Horticulture and Landscape Architecture
 Serve as Chair of Committee for Master's Degree Candidate, Vicki Newman (completed 5/3)
 Serve on Committee for Doctoral Candidate, Khalid Al-Saad
 Serve on Committee for Doctoral Candidate, Mark Minton
 Serve on Committee for Master's Degree Candidate, Lee Walls (completed 12/14)
 Bean Improvement Cooperative (BIC)
 Plant Germplasm Operations Committee (PGOC) (Vice Chair 2002)
 PGO, Policy for Acquisition and Distribution Subcommittee (2001-present)
 Washington State University Plant Growth Facilities Committee
 Sigma Xi

AGRONOMIC, GRASS AND SAFFLOWER (V. Bradley, B. Guenther)

Activities

The Agronomy regeneration program personnel are responsible for maintaining the grass and the *Carthamus* collections.

The *Carthamus* collection at the WRPIS consists of 2,390 accessions, distributed among seven genera. Of these, 2, 317 are accessions of cultivated safflower. One hundred and fifty

accessions of safflower were planted for seed regeneration at Central Ferry, WA. Selected descriptor data were taken on these accessions as well as on a nursery of 53 accessions planted for ornamental evaluation. Thirty accessions were grown at the Parlier, California site for seed increase. We also started a project to collect data on seed color, seed shape, and presence/absence of pappus in all the safflower accessions.

Many *Carthamus* species, except *C. tinctorius*, are “weedy” or classified as noxious weeds in the United States. However, in Spain, certain wild *Carthamus* species are naturalized and none are labeled as noxious weeds. In a continuing cooperative agreement, managed by Dr. Richard Johnson, *Carthamus* species are regenerated by Dr. Jose Fernandez Martinez of Instituto de Agricultura Sostenible(CSIC) in Cordoba, Spain. Eleven accessions were sent to Dr. Fernandez-Martinez in 2001. After this initial regeneration, the species listed as Federal or Washington Class A noxious weeds (currently *C. oxyacanthus*) will be regenerated as described in the Noxious Weeds section of the station Operations Manual. Other species will be carefully managed to prevent weed infestations.

The temperate grass collection consists of 17,612 accessions and represents approximately one quarter of the WRPIS holdings. There are 102 genera and 862 species. We planted 575 grass accessions for regeneration in the 2001 nurseries. We harvested approximately 600 grasses in the second year 2000 nurseries as well as 200 first year grasses.

We made many changes and improvements in the grass regeneration program last year and we continued this trend in 2001. We pre-germinated accessions in plastic germination boxes prior to planting into flats. This allowed us to optimize space usage in the bubblehouse. We used styrofoam planting flats that were more compatible for use with the tranplanter than the metal flats used in the past. These flats held more plants and made it practical for us to increase the plant population of grass regeneration plots from 60 to 100 when enough seed was available. The isolation distance between cross-pollinating accessions was increased to 50 meters both within and between planting strips in each grass nursery.

Research Activities

In a cooperative effort with the Research Agronomist, we completed the field work in an experiment to continue our analysis of harvest methods in grass regeneration plots. Further processing of the harvested material is underway.

The Station Geneticist helped us start a project to use molecular characterization to distinguish differences in three seed lots of *Elymus trachycalus* ‘Primar’. This study approximately half finished.

Talks and Presentations

Jan. 31 Presented lunchtime video “Jubilee Singers: Sacrifice and Glory” to interested

- USDA, ARS employees at the Pullman location in observance of Black History Month.
- Mar. 5 Presented seminar “Managing the U.S. temperate grass collection” to Crop and Soil Sciences Department, Washington State University.
- Feb. 12 Poster presentation “An assessment of grass regeneration nurseries at the Western Regional Plant Introduction Station, 1994-1997. ” at the XIX International Grassland Congress, Sao Pedro, SP, Brazil.
- Jul. 23 Poster presentation “ Managing the U.S. safflower collection.”at the Vth International Safflower Conference, Williston, SD and Sidney, MT.
- Oct. 20 Presented annual summary of the grass regeneration program at the Forage and Turfgrass CGC meeting in Charlotte, NC.
- Dec. 6 Presented lunchtime video “The Reindeer Queen: The story of Alaska’s Sinrock Mary” to interested USDA, ARS employees at Pullman location in observance of Native American Heritage Month.

Travel, Invitations, Special Awards and/or Assignments

- Feb.10-22 Attended XIX International Grassland Congress, Sao Pedro, Sao Paulo, Brazil.
- Jul. 22-26 Attended Vth International Safflower Conference, Williston, SD and Sidney, MT.
- Oct. 21-24 Attended ASA-CSSA-SSSA Annual Meetings, Charlotte, NC.
- Nov. 29 Attended Grass Seed Cropping Systems for a Sustainable Agriculture annual meeting, Moscow, ID.

Committees, Other Assignments, Activities and News

- Ex-officio member of the Forage and Turf Grass Crop Germplasm Committee.
- Ex-officio member of the New Crops Crop Germplasm Committee.
- Member of the Association for the Advancement of Industrial Crops.
- Member of the Turfgrass Breeders Association.
- Member of the Crop Science Society of America.
- Member of the Western Society of Crop Science.
- Member of USDA,ARS Pullman location Career and Community Development Committee.
- Adjunct Scientist, Crop and Soil Sciences Department, Washington State University.
- Editor of WRPIS safflower data link on FAO Ecoport website.
- May 14 Completed mandatory purchase card refresher training.
- May 21 Completed mandatory online security training.
- Jun. 21 Gave tour of grass nurseries to visiting scientists from China and Mongolia.
- Jul. 31 Gave tour of safflower nurseries to visiting scientists from China and Australia.
- Nov. 8 Hosted pot-luck lunch in observance of Veteran’s Day.
- Nov. 11 Prepared annual report on safflower for New Crops Crop Germplasm Committee. It was included in report given by the Horticultural Crops Curator, Barbara Hellier, at the New Crops Symposium, Atlanta, GA.
- Nov. 13 Completed mandatory online ethics training.

Plans for 2002

1. Regenerate 600 grass accessions and 200 safflower accessions.
2. Refine grass harvest methods to reduce the amount of labor needed for harvesting and cleaning, while optimizing genetic diversity in harvested seed.
3. Conclude 'Primar' study.
4. Conclude collection of seed descriptors on safflower.
5. Plant available *Lolium multiflorum* accessions for evaluation of selected morphological characters.
6. Discuss regeneration procedures and conduct nursery tours at the 37th Grassbreeders Work Planning Conference.
7. Utilize digital camera to collect safflower images for downloading onto GRIN.
8. Develop species time schedule for planting grass accessions in germination boxes in order to increase uniformity of plants. This should result in more efficient use of the mechanical transplanter.
9. Attend UNIX class at Washington State University.

COOL SEASON FOOD LEGUMES (C. Coyne, M. Cashman)

Activities

Cool Season Food Legume germplasm regenerating and evaluation activities to preserve genetic integrity and diversity were carried out in greenhouses, screen houses, and fields in Pullman and Central Ferry, WA. Evaluation data was collected on germplasm evaluations of *Cicer*, *Pisum*, *Lens*, *Lupinus*, *Vicia faba*, and *Trigonella* and entered into GRIN in 2001 (6625 data points plus 20,385 data points from collaborators). The 2001 focus in the greenhouse regenerations of *Cicer*, *Pisum*, *Vicia*, and *Lens* were accessions with low seed quantity (i.e. accessions without regeneration seed numbers for normal increase in the field, or screen house in the case of *Pisum*). Accessions were increased in the greenhouse to provide sufficient seed for full regeneration and evaluation in the field and screen house 2002. Field regenerations at Central Ferry were 246 *Cicer arietinum* including 255 *Pisum sativum* for 2002 international genotype x environment study of *Aphanomyces* root rot resistance. Perennial *Cicer* were maintained and harvested accessions at Spillman farm and Observatory Hill farm, Pullman. New activities for 2001 included a transplant program for four *Lupinus* annual species; an *in vitro* germination program for previously difficult-to-germinate perennial *Cicer* species; establishment of a new drip irrigated and fenced perennial *Cicer* field planting at Observatory Hill farm; implementation of controlled pollination conditions for twenty *Vicia faba* and twelve annual *Lupinus* accessions at Pullman, WA. Other regenerations included 24 *Lens*, 49 annual *Cicer*, 217 *Pisum*, 6 *Trigonella*, 20 perennial *Cicer*, 20 *Vicia* perennial species and 20 *Lathyrus* perennial species. Chemical control of pod dehiscence (replicated two year field experiment) using *Lens culinaris* started in 2000 will be continued in 2002. Virus indexing for seed-borne viruses in *Lupinus* accessions was introduced in 2001 and will be continued in all future regenerations.

Regeneration population size was increased for all cool season food legume taxa in 2001.

Research Activities

The cool season food legume research program objectives are to 1) expand genetic marker and comparative genomic characterizations of cool season food legumes and transfer this information to the scientific community and 2) develop, maintain, and enhance genetic marker and genomic data management and bioinformatic capabilities associated with these crops. Good progress was made on the marker development and development of genomic tools in 2001. Significant progress in genomic tool development was the completion of 2X haploid-genome-equivalent large-insert library of pea and publication of the 3.8X BAC library of chickpea. Molecular genetics of disease resistance in *Pisum sativum* germplasm under investigation includes Fusarium wilt and QTL analysis of Aphanomyces root rot resistance of germplasm in multiple environments in collaboration with Pillsbury Co., Crops and Food Research, New Zealand and INRA, France. The most significant contribution was the characterization of germplasm using QTL markers conferring field resistance to Aphanomyces root rot in pea (manuscript accepted). Three closely-linked markers to Fusarium wilt race 1 were also identified (manuscript submitted).

Talks and Presentations

- Feb. 26 Invited to present seminar at Crop Science Seminar Series, Washington State University, "Quantitative genetics of Aphanomyces root rot resistance in peas", Pullman, WA.
- April 17 Invited talk "Breeding for quantitative resistance to Aphanomyces root rot in pea" at Horticulture Seminar Series, Oregon State University, Corvallis, OR.
- July 5-7 Invited as an observer and presented talk at Third Meeting of the Working Group on Grain Legumes, ECP/GR, Regional Office for Europe, International Plant Genetic Resources Institute, Rome Italy. Krakow, Poland.
- July 10 Invited to present talk by organizers of European Grain Legume Association meeting on "Positional cloning of Fusarium wilt resistance genes in pea", Krakow, Poland.
- Nov. 28 Invited to present talk on "Pea Germplasm Research," by Pacific Northwest Vegetable Growers Association, Pasco, WA.

Travel, Invitations, Special Awards and/or Assignments

- Jan. 15-18 International Plant and Animal Genome IX meeting, San Diego to present one research talk and co-author five poster presentations.
- Feb. 1-2 Cool Season Food Legume Research meeting, Univ. of ID, to present research report and research proposal.
- Feb. 5-9 Southern Illinois University, Carbondale, IL to prepare macroarray filters of

- pea BAC library.
- May 17-18 Washington State University, Mount Vernon Research and Extension Unit, Mount Vernon, WA lupin and pea cooperative research.
- Jul. 5-7 European Union legume germplasm meeting, observer and presented US germplasm report. Krakow, Poland.
- Jul. 8 - 12 European Grain Legume Association (AEP) to present invited talk and co-author invited presentation, Krakow, Poland.
- Oct. 22-25 ASA-CSSA-SSSA Annual meeting, Cool Season Food Legume CGC and Clover and Special Purpose Legume CGC, Charlotte, NC
- Oct. 29-30 North American Pulse Improvement Association (formerly National Pea Improvement Association), Pisum Crop Germplasm Committee, Fargo, North Dakota.
- Dec. 10-14 Collaborative research on pea seed borne mosaic virus testing USDA-ARS Hort Crop Research unit, Corvallis, OR

Committees, Other Assignments, Activities and News

Ex-officio member, Cool Season Food Legume Crop Germplasm Committee.

Ex-officio member, Pisum Crop Germplasm Committee.

Member, Washington State University, Graduate School Faculty.

Major advisor, Melissa McClendon, Master of Science candidate, Department of Horticulture, Washington State University, Pullman, WA

Co-Major advisor, Makito Mimura, Master of Science candidate, Department of Crop and Soil Science, Washington State University, Pullman, WA

Member, graduate student committee, Jena Lewinsohn, Master of Science candidate, Department

of Botany, Washington State University, Pullman, WA

Member, graduate student committee, Kyung-Mi Yun, M.S. candidate in Horticulture at Washington State University, Pullman, WA

Member, graduate student committee, Jason Waller, M.S. candidate in Plant Science at Montana State University, Bozeman, WA.

Member, Ad Hoc Committee ARS Pullman Location to purchase two gene sequencers and microarray equipment.

Member, American Association for the Advancement of Science

Member, Crop Science Society of America

Member, North American Pulse Improvement Association

Member, AEP, European Association for Grain Legume Research

Acting Research Leader November 19 through November 23 in the absence of Dr. Hannan.

Melissa McClendon, received her Master of Science, Department of Horticulture, WSU July 27, 2001. She has accepted an Ag Research Technician position with the Dept. of Crop and Soil Sciences at WSU to manage the Spring Wheat Breeding program's molecular lab.

Makito Mimura, received her M. S. degree from the Department of Crop and Soil Science, WSU July 26, 2001. She has accepted a Graduate Research Assistantship to continue her studies in conservation genetics for her Ph.D. at the University of British Columbia.

Jena Lewinsohn, received her Master of Science, Department of Botany, WSU April 13, 2001. Co-PI on 2001 USDA-CSREES Cool Season Food Legume Special Research Grant on Fusarium wilt race 2 of pea, \$22,500.

Coyne wrote and receive funding for Plant Exploration germplasm collection trip to south-eastern

Turkey for June-July 2002 to collect wild *Lens* and *Cicer*.

Organized workshop with Debra Inglis and Kevin McPhee for pea researchers on disease screening and application of molecular markers in screening germplasm, October 10, 2001, WSU, Pullman, WA

Plans for 2002

1. Expand transplant program for *Vicia* and *Lupinus* species.
2. Continue *in vitro* germination program of wild perennial *Cicer*, expand to include wild annual species.
3. Complete the second year of field experiment of chemical control of pod shatter on lentil, write report for WRPIS and submit manuscript to J. of Applied Seed Production.
4. Expanding the insect-pollination program for *Vicia faba* germplasm and for other insect-pollinated *Vicia* species at Pullman, WA.
5. Submit USDA-NRI competitive grants to fund genomic approaches to assess allelic diversity in germplasm collections.
6. Present invited talk January 12, 2002, "Invited to present seminar "Progress in identifying QTLs for resistance to *Aphanomyces* root rot in pea" at the International Plant and Animal Genome X conference: Edible Legumes Workshop.
7. Participate in a plant disease symposium on cool season food legumes organized by the USDA-ARS Grain Legume Genetics and Physiology Unit, Pullman, WA, March, 2002.
8. Participate in a USDA-INRA collaboration meeting "Aphanomyces Root rot in legumes" in France on June 10-14, 2002.
9. GIS analysis of the cool season food legume genera collected in Turkey, an important center of diversity of cool season food legume germplasm.

HORTICULTURE CROPS (B. Hellier, R. Staska)

Activities

The Western Regional Plant Introduction Station Horticulture Crops program has curatorial responsibility for 208 genera. The major collections within this program are *Lactuca* (1406 accessions), *Allium* (941 accessions), *Astragalus* (752 accessions), *Onobrychis* (604 accessions), *Papaver* (557 accessions), *Sanguisorba* (126 accessions), *Hedysarum* (110 accessions), *Scorpiurus* (80 accessions), *Anthyllis* (66 accessions), *Plantago* (59 accessions) and *Salvia* (48 accessions). The remaining 197 genera are represented by 45 or fewer accessions each. The total number of accessions maintained by the Horticulture Crops program is 5,765.

Increase activities were the major focus in 2001 for the Horticulture Crops program. 770 increase plots were established/maintained/harvested during the year for accessions in the following genera: *Achillea*, *Allium*, *Amorpha*, *Anthyllis*, *Asclepias*, *Astragalus*, *Borago*, *Callistephus*, *Camphorosma*, *Echinops*, *Echium*, *Eschscholtzia*, *Genista*, *Glycyrrhiza*, *Hedysarum*, *Hippocrepis*, *Iris*, *Krascheninnikovia*, *Lactuca*, *Lavandula*, *Lunaria*, *Lycium*, *Marrubium*, *Nepeta*, *Onobrychis*, *Oxytropis*, *Papaver*, *Plantago*, *Polygonum*, *Sanguisorba*, *Salvia*, *Satureja*, *Scabiosa*, *Scorpiurus*, *Sphaerophysa*, *Teucrium*, *Thermopsis*, *Thymus*, and *Tragopogon*. Many of the species in the program require 2-4 years of growing time before producing seed. Consequently, our increase plots are long term projects. Also, the majority of the species within the program need multiple harvests per year and can only be harvested by hand. Both of these factors limit the number of accessions which can be grown each year.

Maintaining and distributing the *Allium sativum* collection continues to be another major activity for the Horticulture Crops program. We currently have 246 accessions in the *A. sativum* collection that require yearly increase. The Horticulture Crops program staff continue to package all seed orders for garlic. There were 22 requests with 994 bulb packets distributed in 2001.

Research Activities

In 2001, we continued with the trial to determine optimal pollinator density for increasing *Allium ampeloprasum* accessions. 28 plots with 70 plants each were established this fall for caging in 2002.

Talks and Presentations

- | | |
|---------|--|
| Jun. 6 | Russ Staska gave tour of the garlic increase nurseries to Dr. Manford Morris of Little Rock, Arkansas. |
| Jul. 16 | Presented a program summary to the Herbaceous Ornamental Crop Germplasm Committee, Columbus, Ohio. |
| Jul. 22 | Presented a program summary to the Leafy Vegetable Crop Germplasm Committee, Sacramento, California. |
| Jul. 24 | Presented a program summary to the Root and Bulb Crop Germplasm Committee, Sacramento, California. |
| Aug. 1 | Gave tour of garlic nurseries and storage facility to Joel Reiten, Bejo Seeds and Clay Zumwalter, Three Oaks Farms, Cottage Grove, Oregon. |
| Oct. 16 | Gave tour of garlic storage facility to Mary Jane Butters, Moscow, Idaho. |
| Oct. 21 | Presented a program summary to the Clover and Special Purpose Legume Crop Germplasm Committee, Charlotte, North Carolina. |
| Nov.11 | Presented a program summary to the New Crops Crop Germplasm Committee, Atlanta, Georgia. |

Travel, Invitations, Special Awards and/or Assignments

- Jun. 25 - 29 Traveled to Fort Collins, Colorado, to attend the Plant Germplasm Operations Committee meeting.
- Jul. 15 - 17 Traveled to Columbus, Ohio, to attend the Herbaceous Ornamental Crop Germplasm Committee meeting.
- Jul. 21 - 25 Traveled to Sacramento, California, to attend the Root and Bulb and Leafy Vegetable Crop Germplasm Committee meetings and the 98th Annual Conference of the American Society for Horticultural Science.
- Jul. 26 Traveled to Davis, California, to meet with Dr. Mike Sanderson regarding *Astragalus* and to tour the NPGS National Clonal Germplasm Repository for Fruit and Nut Crops.
- Oct. 20 - 22 Traveled to Charlotte, North Carolina, to attend the Clover and Special Purpose Legume Crop Germplasm Committee.
- Oct. 26 Traveled to Pasco, Washington, to attend a Nation Allium Research Conference Planning Committee meeting.
- Nov. 9 - 13 Traveled to Atlanta, Georgia, to attend the New Crops Crop Germplasm Committee meeting and the New Crops and New Uses : Strength in Diversity Symposium.

Committees, Other Assignments, Activities and News

Ex-officio member of the Root and Bulb Crop Germplasm Committee.
 Ex-officio member of the Leafy Vegetable Crop Germplasm Committee.
 Ex-officio member of the Herbaceous Ornamental Crop Germplasm Committee.
 Ex-officio member of the New Crops Crop Germplasm Committee.
 Ex-officio member of the Clover and Special Purpose Legume Crop Germplasm Committee.
 National Allium Research Conference Planning Committee.

Training:

- Jan. 19 Seminar: Create Your Own Web Page, WSU, Pullman, Washington. (Russ Staska)
- Jan. 23 Seminar: MS Windows, WSU, Pullman, Washington. (Russ Staska)
- Jan. 30 Seminar: Word Processing in MS Word., WSU, Pullman, Washington. (Russ Staska)
- Jan.31-Feb 1 Washington State Pesticide Applicator Licence recertification training, Moscow, Idaho. (Barbara Hellier and Russ Staska)
- Feb. 13 Seminar: MS Access, WSU, Pullman, Washington. (Russ Staska)
- Feb. 27 Seminar :Performance Evaluations, WSU, Pullman, Washington.(Barbara Hellier)
- Mar. 6 Seminar: Valuing Diversity, WSU, Pullman, Washington.(Barbara Hellier).
- May 4 USDA Computer Security training.(Barbara Hellier)
- May 4 Medic First Alert refresher First Aid., WSU, Pullman, Washington.(Barbara Hellier)
- May 14 USDA Visa Purchase card training.(Barbara Hellier)

Plans for 2002

1. Field and greenhouse increases: Most of the genera in the program have accession which are unavailable or are not backed-up at the National Seed Storage Laboratory. We will continue to increase accession with low quantity, germination or are not backed-up. (Genera to be started not yet chosen as of 1/21/02.)
2. *Allium ampeloprasum* pollinator density trial: In cooperation with Dr. Steve Clement and the Station entomology program we will continue with the replicated trial to determine optimal fly densities needed for pollination of *Allium ampeloprasum* within our controlled pollination units.
3. Information gathering: Many of the species represented within the collections maintained by the Horticulture Crops program are wild relatives of cultivated species. Little to no cultivation and pollination biology information is easily available for these species. A major task for the Horticulture Crops program is finding this type of information on the program species. Information gathering is planned for 2002 with an emphasis on *Erlangea*, *Teucrium*, *Hippocrepis*, *Leavenworthia*, *Alhagi*, *Peltaria*, *Kniphofia*, *Mammillaria*, *Glycyrrhiza*, and wild species of *Lactuca* native to North America.

BEETS (A. Hodgdon)

Activities

Seed Increases

Fifty accessions were started for seed increase at W-6 in 2001. Fifty-eight accessions were harvested from plants started in 1998, 1999, 2000, and 2001. Two accessions in the increase program in 2001 did not germinate. One of these we will try to redo. The other accession has no good regeneration seed left, and what remains is a good quantity of open pollinated seed.

Germination tests of the 2001 increase seed will be done in 2002. The *Beta* increase program has a carryover of fifty-four accessions from 2001 to 2002 partly due to incomplete flower induction. Flowering deinduction seems to occur when growth conditions, especially night temperatures, are too warm. This problem has been solved in some of the greenhouse rooms where we can control the temperature well. Deinduction is also a problem in field increases of wild *Beta* accessions. We now have nineteen greenhouse rooms usable for year round seed increases, and four other rooms that can be used part of each year. These rooms give a potential increase of about sixty accessions per year.

Seed Germination

One hundred sixty-two accessions of *Beta* were germination tested in 2001. Ninety-four of the tested lines were from increases done here in 1999, 2000, and 2001. Other material tested was new accessions from breeders. Only one of the tested accessions had less than 50% viability, but seventy-eight had greater than 50% dormancy. Much of the dormancy was in newly increased seed. There is a large backlog of *Beta* accessions that needs germination testing. Only 1140 of 2434 *Beta* accession (46%) have been germination tested in the last ten years.

Seed Storage Activity

A total of 354 accessions were distributed in 2001 in twenty-eight seed orders. We acquired 105 new accessions, 99 of these were from NSSL.

Accession Evaluations.

In 2001 we continued the accession evaluation program with seven evaluators participating from stations around the United States. Accessions were evaluated for response to seven diseases, three insect and nematode pests, and for a series of agronomic traits. Twenty or thirty accessions were done by each evaluator depending on the resources of the evaluator. Evaluation data is entered into GRIN by W-6 staff

In 2001 I compiled descriptor information on 520 accession from field and greenhouse notes taken in the W-6 increase program since 1993. Also I started a systematic charting of seventeen descriptors that can be taken during accession increases. This data has been put on a spread sheet along with seedling emergence data, and will be entered into GRIN. Pictures are being taken of accessions being increased, and are entered into GRIN.

Committees, other assignments, activities and news

WSU Growth Facilities Advisory Committee
Beta Crop Germplasm Committee

Plans for 2002

I plan to work on the deinduction problem in wild accessions of *Beta vulgaris*. I will continue to collect descriptor data on increase material, and to take digital pictures of plants being increased. I will work on the *Beta* Operations Manual. In 2001 we received forty-one seed samples of accessions either missing from our collection or in critically low supply. These have been added to our highest priority increase list, and will be grown as soon as possible.

PHASEOLUS (M. Welsh, J. Thayer, R. Yarbrough)

Activities

During 2001, 481 accessions from the bean collection were increased. All accessions in the increase cycle were tested for the presence of BCMV (poty viruses) and presently 18.4% of the collection is labeled 'tested virus-free'. During the year 19 accessions, testing positive, were run through the virus cleanup program and are now labeled 'tested virus-free'. Twenty-one accessions were increased in sufficient quantity to send as backup to the NSSL.

The BCMV files continued to be updated as data obtained during the increase cycles was collected. The protocol manual of the current lab procedures for the BCMV testing was completed in December 2001, and will be upgraded as needed. The manual is available upon request. The program to clean-up the labeled "non-BF" accessions reached and exceeded the goal of 2 non-BF lines planted and entered per month into the program. This aspect of the program will be continued in the following year with a goal of increasing the number of accessions "cleaned-up".

Two accessions within the collection not previously identified as to species were identified. Additionally, 5 accessions with incorrect identification have been re-identified as to species, and one accession received as an unrecognized-taxonomically- species was labeled as a P. sp. A uniform system of recording increase information, including plant character data, BCMV testing results and harvest results is used in the *Phaseolus* germplasm increase program, and collection and recording of this information was done on a regular basis.

Information contained in the GRIN web-page descriptor site has been updated and continues to be monitored and changed as additional data is obtained. Emphasis is placed on updating the information to keep it a current resource. A program to update and clarify the information in the GRIN passport data successfully entered a large amount of data not previously available in the system. Needed corrections were simultaneously made.

The program for bio-control of insect pests GH 44 was considered extremely successful during the year. The influence of the supplemental light is considered to be the factor overwhelmingly attributable to this success. Bio-control in GH 109 had marginal success-better in spring/summer than in fall/ winter. The GH technician feels that the environment in the house (no lights and difficulty controlling humidity accurately) during the fall/winter months contributes to this lack of response.

The crops harvested from the Central Ferry greenhouse were not as large as in past years. There are several reasons for this; we feel the primary one is that the watering system has developed serious problems that prevent all the lines from receiving an adequate amount of water. Additionally, the house needs some serious re-working on the interior. We plan to put gravel inside to bring the level of the floor up to the concrete walkways-allowing maintenance of the plants to be better conducted, and repair or re-model the watering system to provide the needed water to all lines.

Research Activities

The work in embryo rescue and tissue culture program included the regeneration of one *Phaseolus vulgaris* accession that has not been grown since 1952. Three plants were successfully produced and are growing in the greenhouse. Two plants were produced from *Phaseolus coccineus* accessions that had very recalcitrant seed (we had not been able to germinate any of the seed previously). This method will continue to be applied to the attempts to “rescue” endangered accessions.

The contacts with Dr. Daniel Debouck of CIAT resulted in the acquisition of 15 wild *Phaseolus acutifolius* accessions for the NPGS collection. Further interaction between the two collections is expected in the future.

Talks and Presentations

- May 17 Gave an explanation of germplasm regeneration and a tour of bean greenhouses to members of EDGE TEAMS, Intl., Lewiston, ID.
- May 31 Gave a presentation on the importance of germplasm preservation to the 1st and 2nd grade classes of Mrs. Fadness–Colton, Washington

Travel, Invitations, Special Awards and/or Assignments

- Mar. 2-5 Traveled to Eugene, Oregon, to attend the Farmer’s Cooperative Genome Project and meetings.

Committees, Other Assignments, Activities and News

Member, *Phaseolus* Crop Germplasm Committee
Member, Bean Improvement Cooperative Genetics Committee
Member, W150 Regional Project
Member, Seed Savers Exchange

Plans for 2002

1. Continue to increase the scope of the "BCMV clean-up" program by adding non-BF accessions to the schedule for "clean-up".
2. Further study in the area of *Phaseolus* systematics and botany for purpose of identifying previously unidentified and/ or mis-identified species within the collection.
3. The GRIN (Germplasm Resource Information Network) resource will be kept current and will be maintained as "user-friendly" as is possible.

4. Continue to add and correct old, recorded passport data into the database.
5. Continue the formal study of the Spanish language.
6. The collection will be further organized, making better accessibility to accessions and their related data.
7. All of the regular increase, germplasm acquisition and distribution, and data collection programs are in the 2002 plans.
8. Work in the program to "rescue" endangered accessions through the embryo rescue work. Proposed attendance to classes for purpose of learning the protocol, etc. for handling the information in the GRIN database.
9. Review of "odd" material stored at the W6 site, considering it to be added to the collection.
10. The number of wild *Phaseolus* accessions being grown will be increased; we plan to learn more about how to get better results from such increase attempts.
11. Collaboration with Daniel Debouck of CIAT in a project to coordinate bean germplasm preservation programs in several countries.

ENTOMOLOGY (S. Clement, L. Elberson)

Research Activities

F₃ Seed Increases of Pisum sativum x P. fulvum Crosses. We embarked upon a May-August greenhouse seed increase program to obtain ample quantities of seed from 1995 *Pisum sativum* x *P. fulvum* crosses. Table 1 is a summary of the crosses and seed increased in 2001. We undertook this work because three unrelated studies failed to materialize. First, poor plant establishment doomed the *Allium* pollination study. Second, natural populations of pestiferous aphids never developed on wild barley plots at Central Ferry. Last, another year of Hessian fly sampling at the Ralston cropping systems site was abandoned when fly populations failed to materialize.

Table 1. *F₃* seed increases from *F₂* plants of *P. sativum* (cv. Alaska) x *P. fulvum* crosses, greenhouse increase program, Pullman, WA, 2001

Cross	<i>F₂</i> plants producing seed	Total number of:	
		<i>F₃</i> seed	Sterile <i>F₂</i> plants
Alaska x PI 343955	42 ^a	389	2
Alaska x PI 343955	11 ^b	118	0
Alaska x PI 343955	5 ^c	23	0
Alaska x JI 1796	7 ^d	67	0

Alaska x JI 1796	5 ^e	48	0
Alaska x PIG 296	49 ^f	487	3
Alaska x JI 2205	20 ^g	200	0
Alaska x PI 560065	4 ^h	51	2

^a F₂ plants from plants 16-93 (Alaska) and 49-4 (*P. sativum*).

^b F₂ plants from plants 9-13 (Alaska) and 49-3 (*P. fulvum*).

^c F₂ plants from plants 49-1 (Alaska) and 5-93 (*P. fulvum*).

^d F₂ plants from plants A15 (Alaska) and 2-95 (*P. fulvum*).

^e F₂ plants from plants A16 (Alaska) and 8-95 (*P. fulvum*).

^f F₂ plants from plants 2-95 (Alaska) and 1-95 (*P. fulvum*).

^g F₂ plants from plants A18 (Alaska) and 2205-1 (*P. fulvum*).

^h F₂ plants from one Alaska plant and one *P. fulvum*.

Endophyte Diversity in Tall Fescue Accessions and Aphid Resistance. We completed a series of greenhouse experiments to evaluate 18 tall fescue accessions for resistance to rose grass aphid. Statistical analysis of the results indicates that endophyte presence in tall fescue does not mediate resistance to rose grass aphid.

Wild Barley - Endophytes - Hessian fly Interactions. We initiated a series of laboratory experiments to examine the susceptibility of endophyte-infected wild barley accessions to Hessian fly. Preliminary results indicate that some endophyte-infected accessions are resistant, but additional experimentation is required to determine the value of wild barley endophytes as mediators of barley - Hessian fly interactions. More details will be provided at the conclusion of 2002 experiments.

Pollination of Caged Allium Accessions. Research with Barbara Hellier, W6 Curator, to assess the effectiveness of house flies to pollinate caged *Allium* for seed regeneration at Central Ferry was not conducted in summer 2001 because of poor plant development. A completely new set of plants were transplanted into the field in late-summer. Thus, the horticulture and entomology groups will hope to complete this study in 2002.

Susceptibility of Perennial Grasses to Cereal Aphids. We completed a 3-year study to quantify populations of aphid pests on perennial grasses in replicated plots at Central Ferry. It was our goal to determine if perennial grass taxa in Central Ferry nurseries serve as reservoir sites for pestiferous aphid species. The USDA-NRCS Plant Materials Service at Washington State University provided seed of five perennial grass taxa and Dr. Steve Jones, Winter Wheat Breeder, Washington State University, provided seed of 'perennial wheat' for plot establishment. It was necessary to obtain seed from these sources because the W6 seedbank could not provide sufficient quantities of seed for plot establishment. The grass taxa were: *Agropyron desertorum*,

Elymus trachycaulus spp. *trachycaulus*, *Elytrigia elongata*, *E. intermedia*, *Pseudoroegneria spicata*, and *Thinopyrum ponticum* x *Triticum aestivum*, amphiploid (perennial wheat). No useful data was obtained in 1999, the year the plots were established. In 2000, bird cherry-oat aphid (BCOA), Russian wheat aphid (RWA), and rose grass aphid (RGA) colonized the plots. Tables 2-4 reveal several things, namely: 1. RGA counts were very low on all 2000 sampling dates; 2. perennial wheat consistently supported more BCOA and RWA compared with other entries; 3. most entries supported high numbers of BCOA on 21 March 2000, indicating significant overwintering on these grasses; and 4. changes in aphid densities were not consistently related to changes in plant biomass on each entry (statistics not shown in this report). Only a few BCOA (n = 1), RWA (n = 6), and RGA (n = 22) were counted on the six entries in 2001. In summary, several perennial grass taxa were suitable hosts for aphids and aphid densities differed greatly from year to year. What this means, in terms of seed regeneration activities at Central Ferry, is that grass nurseries can serve as reservoir sites for pestiferous aphids.

Table 2: Aphid densities on perennial grass entries, Central Ferry, WA, 21 March 2000

Entry	Mean plant	Mean no. aphids ^b		
	dry wt. (g) ^a	BCOA	RWA	RGA
Alkar	96.96	6.00 c	0.67 b	0.00
Greenar	98.07	69.67 bc	0.33 b	0.00
Nordan	87.89	175.00 ab	6.33 b	0.33
Primer	110.34	25.33 bc	0.67 b	0.67
Spitzer	122.06	289.00 a	15.00 a	0.33
Whitmar	91.49	55.00 bc	1.67 b	1.33
LSD	-	142.26	6.76	-

Means within a column followed by the same letter are not significantly different. ($P=0.05$; LSD).

^a Based on a 16-inch strip of plant material per plot.

^b Per plot.

Table 3: Aphid densities on perennial grass entries, Central Ferry, WA, 23 Jun 2000

Entry	Mean plant	Mean no. aphids ^b		
	dry wt. (g) ^a	BCOA	RWA	RGA
Alkar	7.54	0.33 b	6.67 b	0.00
Greenar	7.27	8.00 ab	1.33 b	0.66

Nordan	6.71	0.66 b	5.33 b	1.33
Primer	5.78	0.66 b	2.00 b	2.00
Spitzer	15.98	12.67 a	80.00 a	3.67
Whitmar	2.12	1.00 b	1.33 b	0.00
LSD	-	7.82	56.88	-

Means within a column followed by the same letter are not significantly different ($P=0.5$; LSD).

^a Based on 20 tillers per plot.

^b Per plot.

Table 4: Aphid densities on perennial grass entries, Central Ferry, WA, 17 Jul 2000

Entry	Mean plant	Mean no. aphids ^b		
	dry wt. (g) ^a	BCOA	RWA	RGA
Alkar	26.98	0.33	70.00 b	0.00
Greenar	20.87	0.00	9.33 b	0.00
Nordan	16.14	0.00	77.00 b	0.00
Primer	13.20	0.00	9.00 b	0.33
Spitzer	38.52	6.67	1726.67 a	0.00
Whitmar	7.01	0.00	10.00 b	0.00
LSD	-	-	697.76	-

Means within a column followed by the same letter are not significantly different ($P=0.5$; LSD).

^a Based on 20 tillers per plot.

^b Per plot.

Talks and Presentations

- Mar. 7 Gave invited seminar, "Cereal Cropping Systems in Eastern Washington: Influence on Pest Insects," Entomology Dept., Montana State University.
- Mar. 8 Gave invited seminar, "Yellow Starthistle Insects in Southern Europe and other Entomological Peregrinations," Entomology Dept., Montana State University.
- Mar. 30 Lectured in Entomology 446/546, Host Plant Resistance, University of Idaho, Moscow.
- Sep. 6 "Fungal Endophyte Diversity in Grasses and the Issue of Aphid Resistance," 6th International Symposium on Aphids, Rennes, France.
- Sep. 10 Gave invited seminar, "Fungal Endophyte Diversity in Grasses and the Issue of

- Dec. 10 Aphid Resistance,” IACR-Rothamsted, Great Britain.
Introductory comments before Program Symposium at Entomological Society of America meetings, San Diego.

Travel, Invitations, Special Awards and/or Assignments

- Jan. 6-9 Portland, Oregon to present two talks at the Pacific Northwest Insect Management Conference.
Mar. 6-9 Bozeman, Montana to give two invited seminar talks.
June 27-29 Berkeley, California for RPES panel duty.
Aug. 25 Invited to write a chapter on endophytes and insect resistance for Encyclopedia of Entomology.
Sep. 1-17 France and Great Britain to give talks and attend meetings. Trip extended due to events of September 11th.
Dec. 8-14 San Diego for national meeting of the Entomological Society of America meetings.
Dec. 10 Awarded a Visiting Fellowship by Grains Research and Development Corporation, Australia, for cooperative research at CSIRO laboratory in 2002.

Committees, Training, Other Assignments, Activities and News

- Member, Arrangements Committee for 2001 meeting in San Diego, Entomological Society of America
Member, Graduate Faculties, Entomology, University of Idaho and Washington State University.
Committee member for two M.S. graduate students
Chair, Awards Committee (2002), Pacific Branch, Entomological Society of America
Faculty Advisor, Alpha Zeta, Washington State University
Reviewed 11 manuscripts for various editors and authors
Received approximately 16 calls of a ‘cooperative extension’ nature on a variety of subjects.
Acting Research Leader on multiple occasions in absence of Dr. Hannan.
Co-organized and moderated a program symposium, “Agricultural Entomology Beyond U.S. Borders: Achievements and Future Directions,” Entomological Society of America meetings, San Diego, and secured program enhancement funds to help bring speakers from Australia and Costa Rica.

Plans for 2002

1. Will work with Ted Kisha on PCR detection of endophytes in tall fescue accessions from W6 seedbank.
2. Will cooperate with W6 *Allium* curator in controlled pollination experiment involving caged accessions and fly pollinators. Will be responsible for the entomological aspects of this study.

3. Will expand upon research started in 2000 on wild barley - endophyte - Hessian fly interactions by conducting a series of laboratory and glasshouse experiments to ascertain levels of resistance in different genotypes and species of wild barley harboring diverse *Neotyphodium* endophytes.
4. Will participate in service work by advising greenhouse managers and curators on pesticides to control insects and mites in W6 greenhouses devoted to seed increases.
5. Will conduct cooperative research in Perth, Australia with CSIRO colleagues to ascertain levels of *Helicoverpa* resistance in wild *Cicer* accessions from W6 seedbank and other repositories.
6. Will analyze Hessian fly data from cropping systems study and prepare a manuscript on the results.

PLANT PATHOLOGY (F. Dugan, S. Lupien)

Activities

The cooperation of the pathologist was elicited by scientists, curators and technicians within WRPIS. Primary examples:

2/7/01; A culture labeled 15825 from Research Entomologist Steve Clement was identified as a *Neotyphodium* on the basis of colony morphology, growth rate, structure and size of conidiophores & conidia, and endophytic habit. The culture originated from a *Lolium* accession which is the subject of Dr. Clement's research.

3/1/01: A meeting was held with Curator Vicky Bradley, Research Entomologist Steve Clement, and farm support staff regarding how to accomplish the dual objectives of managing grass rust and retaining *Neotyphodium* endophyte in grass accessions. Literature searches revealed experimental data but few recommendations of direct practical application. It was decided to start compiling baseline data on rust intensity vs. seed production and quality (see 4/24/01 below) and to exercise restraint with regard to fungicidal applications.

3/7/01: Curator Clare Coyne requested diagnosis for *Ascochyta rabei* in chickpea accessions 595973, 572503, 595983, 572534, 595970, 572519, 572502, 595974, and 596030. The fungus was recovered from two seeds in 595983. I recommended seed be treated with a systemic fungicide. I also recommended that seed known to be highly infested with the pathogen be treated with the systemic fungicide as a test of its effectiveness. The seed accessions above were grown at Central Ferry.

4/2/01: A report was compiled for Curator Vicky Bradley on occurrence, identification and treatment of *Puccinia carthami* (safflower rust) [known from WA] and *Fusarium oxysporum* f.sp. *carthami* [known from CA]. Both are known to be seedborne.

4/20/01: Biological Technician Bob Guenther brought samples of a rust on leaves of W6-17784 *Festuca pratensis* and samples of tip burn on PI 20957 *Leymus cinereus*. The cause of the latter could not be determined; the former contained urediniospores conforming to *Puccinia graminis*.

4/24/01: Rust-rating cards were distributed to Curator Vicky Bradley's crew so that the intensity of rust infection could be monitored at Central Ferry. Vicky wants to know how the level of rust infection affects seed production.

6/7/01: Curator Barbara Hellier brought from the Lonestep garden in Pullman an accession of *Allium altaicum* W6-18947 with sori on the leaves. The pathogen was a rust in the genus *Puccinia*. Examination at 400X revealed yellow-orange, globose to elliptical urediniospores, ca. 25.2-30.8 x 18.9-23.8 microns. The spores were conspicuously thick-walled, with indistinct pores which were *not* equatorial. No telia or aecia were seen. The description of *Puccinia porri* (*P. allii*) given in Compendium of Onion and Garlic Diseases (1995, APS Press) gives urediniospores as 23-29 x 20-24 with thick walls. The match to the above material is not exact, but the Compendium stresses that the pathogen is variable and that several names and descriptions have been published. There are a number of very similar species in *Puccinia* (given in Farr et al. 1989, Fungi on Plants and Plant Products in the United States), but there is little hope of distinguishing most of them in the absence of production of teliospores (see Arthur's Manual of the Rusts in the U.S. and Canada, 1962 reprint; also Hotson's Key to the Rusts of the Pacific Northwest, 1934. The CMI description (no. 52) says the pores of *P. asparagi* are equatorial; the pores of the rust on W6-18947 are not equatorial. The Compendium recommends fungicidal applications, including maneb; p. 892 in the CPR 2000 has maneb against rust on onion.

6/25/01: Curator Allan Hodgdon and I visited the bubblehouse in Pullman. Four plants out of ca. 90 appeared abnormal with symptoms which looked suspiciously viral in origin but which did not match photos in the APS Compendium of Beet Diseases with the exception of one plant whose symptoms were similar to those of cucumber mosaic virus or beet mosaic virus. All four plants were rogued and autoclaved. Alan indicated that powdery mildew problems were much abated due to increased air circulation. I saw no mildew symptoms.

7/3/01: Curator Barbara Hellier brought two plants of W6 1860 *Allium sativum* var. *sativum* from the farm in Pullman. Sclerotia removed from the plants produced *Botrytis* conidiophores growing directly from the sclerotium. Conidia did not conform precisely to the dimensions of any listed in Ellis (1971, Dematiaceous Hyphomycetes) for *Botrytis* species attacking *Allium* and opinions differ regarding the taxonomy of species pathogenic to *Allium* (Compendium of Onion and Garlic Diseases, 1995). Usually, *B. porri* is the name given to *Botrytis* from garlic & leek, whereas *B. allii* is associated with onion, garlic, shallots, and leek. With regard to control, the Compendium stresses regulation of irrigation to avoid over-watering

7/20/01 Biological Technician Mike Cashman. Mike and I went to the greenhouse 109B, and he showed me the bays with ca. 10 sick plants out of ca. 300. *Fusarium* was consistently isolated from diseased but not healthy plants. Morphology would be congruent with either *F. solani* or *F. oxysporum*. Symptoms were a *very* close match to those given in Fig. 9.3 in Haware's article on diseases of chickpea in Pathology of Food and Pasture Legumes (ICRISAT, 1998) for black root

rot of chickpea, the agent of which is *Fusarium solani*. The ICRISAT bulletin No. 3 'Diagnosis of some wilt-like diseases of chickpea' by Nene, Haware & Reddy (1978) stresses that the wilt due to *Fusarium oxysporum* f.sp. *ciceri* does *not* cause rotting or discoloration on the outer surface of the root such as was observed in the plants Mike brought to the lab. *F. solani* is already known as an agent of root rot of chickpea here on the Palouse, but *F. oxysporum* f.sp. *ciceri* is not yet known here. The report was forwarded to Curator Clare Coyne.

8/13/01: Biological Technician Bob Guenther brought a sample of diseased safflower (*Carthamus tinctorius* PI 283771) from Central Ferry. It contained telia and teliospores of *Puccinia calcitrapae* var. *centaureae* (D.C) Cumm.; a synonym is *Puccinia carthami* Corda. There are several other synonyms given in: Cummins, G.B. 1978. Rust Fungi on Legumes and Composites in North America. Univ. of Arizona Press, Tuscon, Arizona. The disease has been reported from Washington and neighboring states, the southwest, the Dakotas, etc. Richardson (1990, An Annotated List of Seed-Borne Diseases, ISTA) says it's seed borne. The URLs of web sites dealing with control of this disease were listed and the report copied to Curator Vickie Bradley.

8/31/01; Instructed Biological Science Technician William Luna on how to monitor new growth of beets and peas for powdery mildew and how to use results for modification of spray schedules. Noted that the fungicide Strike must be used against mildew in rotation with other fungicides.

Provision/curation of microbial strains:

Strains of *Ascochyta rabei*, *Mycosphaerella pinoides*, *Ascochyta pisi* and *Phoma medicaginis* var. *pinodella* provided to Tobin Peever.

Strain of *Fusarium oxysporum* f.sp. *pisii* race 1 provided to Tim Murray.

Strain of *F. oxysporum* var. *ciceri* provided to Fred Muehlbauer.

Several *Fusarium oxysporum* f.sp. *pisii* strains (various races) from John Kraft preserved in liquid nitrogen.

Numerous other strains of significance to W6 crops were preserved on silica gel or in liquid nitrogen.

Research Activities:

1. Fungi quiescent in grasses and grass seeds

Rationale: There is little published information on fungi which reside in grass seed without producing symptoms. WRPIS conserves seed of over 16,350 accessions (over 800 species) of grasses. Because of the increasing attention paid to quiescent and endophytic infections of plants, and because fungi may be distributed along with the seeds of the host, we have undertaken a floristic survey of such fungi in grass seeds. We have also examined vegetative tissues of the same hosts. We focused on important forage and weedy grasses endemic (but not necessarily native) to the Pacific Northwest.

Summary: For each of two growing seasons (1999, 2000) we have plated 100 seeds and 50 culm

nodes onto agar for each 14 species (*Aegilops cylindrica*, *Agropyron cristatum*, *Agropyron repens* (*Elytrigia repens*), *Agropyron spicatum* (*Pseudoroegneria spicata*), *Arrhenatherum elatius*, *Avena fatua*, *Bromus inermis*, *Bromus tectorum*, *Elymus cinereus* (*Leymus cinereus*), *Festuca idahoensis*, *Dactylis glomerata*, *Phalaris arundinacea*, *Phleum pratense*, and “feral” *Triticum aestivum*). For all taxa but *B. inermis* and *Triticum* we subjected seeds of PI accessions to the same procedures. The predominant fungi isolated were strains of dematiaceous hyphomycetes, principally strains of *Alternaria* and *Cladosporium*. *A. infectoria* was the species most frequently isolated from seed. *A. tenuissima* was common and *A. alternata* was rare. *Aspergillus*, *Penicillium* and *Fusarium* were very rare or absent in stored germplasm. Pathogenic coelomycetes were common in asymptomatic node samples, occasionally present in asymptomatic field seed, but were not detected in germplasm accessions. Reports of frequent occurrence of *Alternaria alternata* in grass seed should be viewed with skepticism if this species is not distinguished from *A. infectoria*. As of 1/4/02 the manuscript (Dugan and Lupien) was returned to *Mycopathologia* with the minor revisions requested by the Editor.

2. Production of keys and/or descriptions graminicolous *Alternaria* species

Rationale: In our studies of fungi from grasses, *Alternaria* was the most commonly isolated fungus from seeds and culm nodes of grasses. Other than *Fusarium*, *Alternaria* is the genus with the most entries in standard texts of seed pathology (Agarwal and Sinclair, 1997, Principals of Seed Pathology, 2nd ed., CRC; Maude, 1996, Seedborne Diseases and their Control, CAB). *Alternaria* species occur endophytically in other plants with effects on vertebrate herbivores (Braun and Liddell, 1998, Phytopathology 88:S10) and are known producers of mycotoxins in Gramineae and other plants (Chelkowski and Grabarkiewicz-Szczesna 1991, *Alternaria* and their metabolites in cereal grain, in: Cereal Grain Mycotoxins, Fungi and Quality in Drying and Storage, Elsevier; Chelkowski and Visconti (eds), 1992, *Alternaria* Biology, Plant Diseases and Metabolites, Elsevier). *Alternaria* species are agents of black point, black head & other diseases of graminicolous plants. Available taxonomic treatments of the genus *Alternaria* are inadequate for identification and keying of graminicolous species of *Alternaria*. (The limitations of each of the previously published keys and sets of descriptions are specifically addressed in my progress report for the previous year.) We will collaborate with Tobin Peever’s lab in testing the conclusions of this portion of the work by molecular-genetic methods. Summary: Using type, authentic and other well-documented materials, we have now produced photographs and a morphotaxonomic key to the following graminicolous species: *Alternaria alternata*, *A. cetera*, *A. infectoria*, *A. longissima*, *A. japonica*, *A. metachromatica*, *A. oregonensis*, *A. padwickii*, *A. saparva*, *A. tenuissima*, *A. triticicola*, *A. triticimaculans* and *A. triticina*. Interim results were subjected to RMIS review, published as an abstract and presented as a poster at the joint annual meeting of the American Phytopathological Society and the Mycological Society of America. Keys were distributed on request to persons in ARS, APHIS, and private & academic laboratories. The full manuscript (Dugan and Peever) is currently undergoing pre-submission review.

3. First Report of Pink Seed of Pea Caused by *Erwinia rhapontici* in the United States

Rationale: The USDA Federal Grain Inspection Service (FGIS) submitted samples of discolored peas to WRPIS. FGIS suspected the seed might have been contaminated with pink-colored, pesticide-coated seed. The seed lot had been impounded and withheld from the market.

Summary : Testing in our lab and in collaboration with the laboratory of Brenda Schroeder (Department of Plant Pathology, Washington State University) demonstrated that the condition was caused by infection with *Erwinia rhapontici*, agent of pink seed of pea, formerly reported from Alberta, Canada. A Disease Note was authored by Schroeder, Lupien and Dugan; it was accepted for publication Nov. 8, 2001.

4. Documentation of epiphytic growth and sporulation of the endophyte of wild barley on the surface of its host:

Rationale: Although conventional wisdom has it that *Neotyphodium* endophytes are primarily endophytic, there have been reports of such fungi growing and even sporulating on host surfaces (Moy et al. 2000. *Symbiosis* 28:291-302; White et al. 1996. *Mycologia* 88:174-178). We have seen evidence that our system may be similar (Youssef and Dugan 2000). Summary: We have undertaken collaborative research with White's laboratory in documentation of the epiphytic habit of the *Neotyphodium* endophyte of wild barley (*Hordeum brevisubulatum* subsp. *violaceum*). We demonstrated via stained leaf impressions, SEM, and the plating to agar media of leaf washes from the host, that the fungus is able to grow and sporulate on leaf surfaces under laboratory conditions. Superficial mycelium was usually sparse, and mycelial nets were not observed on the leaf epidermis. ITS sequence data were identical for *Neotyphodium* isolates derived from surface-disinfested leaf tissue and from leaf washes. Conidia of the endophyte were capable of germination and growth on nutrient agar. A manuscript authored by Dugan, Sitton, Sullivan and White has been written. As of 2/20/02 the manuscript was accepted for publication in *Symbiosis*.

5. Production of a key for the principal graminicolous *Selenophoma* species

Rationale (*Selenophoma*): Other than the agents of black point (*Alternaria* and *Cladosporium*), *Selenophoma* (*Pseudoseptoria*) was the most commonly isolated pathogen in our studies of fungi quiescent in grass tissues. *Selenophoma* species are agents of halo spot on various cereals and grasses. Published sources for identification (Punithalingam and Waller, CMI Descriptions No. 400, 1973; Smiley et al., Compendium of Turf Grass Diseases, 1992; Sprague, Diseases of Grasses and Cereals, 1950; Sprague and Johnson, Species of *Selenophoma* on North American Grasses, 1950; Sutton, The Coelomycetes, 1980) describe pycnidia and pycnidiospores produced on host plants. However, strains isolated into pure culture, including strains from non-symptomatic host tissues, often fail to produce diagnostic characters matching published descriptions. Cultural characters have not been adequately described. This study has the objective of describing and illustrating diagnostic, morphological characters of the hyphomycetous and yeast-like states which often dominate in agar cultures. Summary: Strains of *Selenophoma* (*Pseudoseptoria*) spp. were isolated into pure culture from asymptomatic, surface-disinfested seeds and/or culms of *Arrhenatherium*, *Bromus*, *Dactylis*, *Phalaris*, and *Pseudoroegneria* species. Strains were examined at 40-1000X with differential interference contrast. Cultures produced hyphomycetous synanamorphs commonly exhibiting synchronous conidia production

typical for members of the *Aureobasidium-Kabatiella* complex. Elongated, micronematous conidiophores bore intercalary and terminal cells with 1-5 conidiogenous loci. Some isolates also produced conidiogenous cells in palisades on a stroma, and a minority of strains readily produced pycnidia similar to those described from the host. Yeast-like polar budding of 1-celled conidia, secondary conidia formation from multiple loci on septate conidia, and catenate conidia were common in most strains. Several strains produced two distinctive conidial morphologies: typical selenophomoid and irregularly vermiform. No annellations could be discerned on conidiogenous loci. Strains isolated from plants by recognized authorities have been obtained from culture collections; strains from Washington and Idaho are now being inoculated into the appropriate hosts to see if specific epithets can be consistently applied from the taxonomic literature cited above. (Initial inoculations in May failed because of unseasonably hot temperatures in the greenhouse). A non-graminicolous species of *Selenophoma* has been obtained for comparison.

6. Fungi endophytic in asymptomatic grape berries and dormant buds

Rationale: Endophytic and/or quiescent fungi have been demonstrated in several horticultural crops, including grapes, in which *Botrytis* is of special interest (Coley-Smith, Verhoeff and Jarvis 1980, *The Biology of Botrytis*; Nair et al. 1995, *Australian J. Exp. Agri.* 35:1177). *Botrytis* is a primary target of standard management practices in central Washington and the Pacific Northwest (Pscheidt, 1997, *An on-line guide to plant disease control*, www.orst.edu/dept/botany/epp/guide; Grove, 1998, *Bunch rot of grape*, <http://disease.tfrec.wsu.edu>). Our objective is to ascertain the degree to which *Botrytis* or other fungi might persist as quiescent infections in non-symptomatic grape tissues in central Washington. A subsidiary objective is to see if prior occupation of wound sites in berries by common fungi other than *Botrytis* forestalls bunch rot caused by the latter fungus. Summary: We have detected presence of *Botrytis cinerea* in dormant buds (1.6-4.8%) and in young grape berries (0.2-0.5%) over two seasons. *Alternaria*, *Cladosporium* and *Ulocladium* appear to predominate; *Aureobasidium*-like strains and lesser numbers of ascomycetes and coelomycetes were recovered. Of the common vineyard fungi recovered into culture, *B. cinerea* has been demonstrated in replicated trials to be the most aggressive in rotting fruit. *B. cinerea* has also been inoculated into wounds previously colonized by other fungi; resulting lesions were smaller than those produced by *B. cinerea* alone, thus demonstrating potential for competitive inhibition of *B. cinerea* by common vineyard fungi.

7. Incidence of *Perenniporia fraxinophila* and its effects on green ash woodlands in eastern Montana

Rationale: I confirmed identification of the pathogen by examination of representative material using Gilbertson and Ryvarden (1987, *North American Polypores*) and Overholts (1967, *The Polyporaceae of the United States and Canada*), and am assisting with data analysis and writing of the manuscript. In return, the principal authors (Conservation Biology Research, Missoula MT) have agreed to deposit seed of diseased and disease-free trees with NPGS. The area under study is one of intense disease pressure from both *P. fraxinophila* and an ash decline of unknown origin. Summary: Incidence of *P. fraxinophila* sporocarps and stem decay was sampled on 17 stands of green ash (*Fraxinus pennsylvanica*) in east-central Montana. *P. fraxinophila* was the only wood rotting fungus observed fruiting in the stands where an average of 38% of trees had

sporocarps. ‘Canopy dieback’ of unknown origin was also prevalent, but there seems to be little evidence that *P. fraxinophila* is causal. *P. fraxinophila* is an agent of bole and branch breakage during severe meteorological events, and thereby a significant factor in promoting open canopies in these prairie woodlands. Authored by Lesica, Atthowe and Dugan, and submitted to Canadian Journal of Botany, November, 2001.

Talks and presentations

Aug. 28-29 Poster: Morphological and cultural differentiation of described species of *Alternaria* from Poaceae by F.M. Dugan and T.L. Peever. Joint Annual Meeting of American Phytopathological Society, Mycological Society of American, and Society of Nematologists, Salt Lake City, Utah.

Travel, Invitations, Special Awards and/or Assignments

Aug. 24-30 Travel to Salt Lake for Joint Annual Meeting of American Phytopathological Society, Mycological Society of American, and Society of Nematologists, Salt Lake City, Utah, August 24-29.

Committees, Other Assignments, Activities, and News (Selected Examples)

Cooperative development and technology transfer: 1) Electronic bibliography for Kaiser/Hannan Reprint Library distributed to WSU and USDA pathologists and breeders, and to Dr. Nalini Mallikarjuna, visiting from ICRISAT (India).

Cooperative development and technology transfer: 2) Provided technical advice and citations for key taxonomic literature to Dan Friedman (<http://www.inspect-ny.com/danbio.htm>) of American Home Service Company (<http://www.inspect-ny.com/>), for analysis of dust from Sept 11 World Trade Center bombing. Mr. Friedman is an indoor air quality professional conducting *pro bono* work for persons whose properties were contaminated.

Past-Chair of Mycology Committee of the American Phytopathological Society. In connection with this office, I reviewed for the Chair one proposal, and presided over one workshop (Fungi and Indoor Air Quality) at the annual APS / MSA meeting in Salt Lake (Phytopathology News 35:151, 2001). Responded to several requests for information from the Chair, and assisted in conducting business at the committee meeting. I assisted compilation of candidate fungi for APS White Paper on sequencing of plant pathogens.

President: Palouse Mycological Association (a mushroom club with community-based activities), a member and affiliate of the North American Mycological Association.

Member, Science and Technology Committee, APHIS implementation working group for National Plant Board Review: Safeguarding American Plant Resources.

Member: Search Committee, WSU Plant Pathology (adjunct faculty). Serve on one graduate committee for a PhD student, and on the search committee for the virologist position.

EEO: Obtained funds for and hosted a woman student summer intern via the ARS Summer Intern Program. Advantages and opportunities of a science career in ARS were made apparent to the intern, who functioned admirably.

Plans for Year 2002:

1. Finish and submit manuscript on morphological and cultural characterization of graminicolous *Alternaria* species. I hope to have molecular work well underway by late winter. The molecular work will represent a testing and continuation of the morphological-cultural work with *Alternaria* taxonomy and will form a separate manuscript.
2. Conduct another round of inoculations on grass species with *Selenophoma* isolates in late fall/winter when temperatures will be cool inside the greenhouse. If the inoculations are successful, characters of pycnidia and pycnidiospores will be compared with published descriptions in order to put species names on isolates. Because culture collection material for *Selenophoma obtusa* proved misidentified or nonviable, and because material for *Selenophoma everhartii* was not available as living cultures, and because reviewers wanted a monographic treatment of graminicolous species, the duration of this project must be extended.
3. Cooperate with Uwe Braun (Martin Luther University, Germany) and Pedro Crous (University of Stellenbosch, South Africa) on studies of *Cladosporium malorum*. Dr. Braun will erect a new genus to accommodate *C. malorum*, the phylogenetic position of *C. malorum* will be assessed via ITS sequence data (this is largely accomplished), and a new variety of *C. malorum*, isolated by WRPIS, will be described (also largely accomplished). Results will be presented as a poster at Mycological Society of America Annual Meeting.
4. Finish and submit manuscript on the quiescent *Botrytis* infections in grape.

AGRONOMY (R. Johnson, C. Foiles)

Activities

Working with the grass curator, we are developing improved standards for regeneration and maintenance of outcrossing grasses. This includes increasing plant populations from 60 to 80+ plants, increasing isolation distance from 25 m 50 m, and developing cost effective sampling methods to reduce genetic drift.

Through a cooperative program with José Fernández-Martínez, oilcrops geneticist and breeder of the Instituto de Agricultura Sostenible CSIC, Córdoba, Spain, numerous accessions of wild

safflower have been grown out that otherwise would have been lost. A proposal was funded through National Center for Genetic Resources Preservation for \$5,000 to continue this program. The remaining safflower wild relatives will be grown in Spain in an effort to save as much of the collection as possible.

Working with Dave Stout and Vicki Bradley, the descriptor data taken in 1996 at the or station on the safflower core has been entered into GRIN.

Working with Gwen Pentecost, a Safflower Web page was developed and is being maintained, see <http://safflower.wsu.edu/>

Assisted in agency recruiting and visibility through WSU and U of I career day (assisted Pam Dean), 2/26.

The following grants were submitted:

Sponsor for Seyyed Saeid Pourdad, Dryland Agricultural Research Station, Sararood, Kermanshah, Iran, for a Valilov-Frankel Fellowship. Project title "Evaluation and Utilization of Iranian Safflower Germplasm" \$22,200 requested. Decision spring 2002.

Sponsor for Selim Aytac Ondokuz Mayıs University, Department of Agronomy, Kurupelit Kampus 55139 Samsun, Turkey for a Valilov-Frankel Fellowship. Project title "Assessing Genetic Diversity in Safflower for Turkey." \$24,100. Decision spring 2002.

Project title "High Yielding Kentucky Bluegrass for Non-thermal Management," to Grass Seed Cropping for a Sustainable Agriculture. Requested \$30,000. Decision spring 2002.

Enhanced germplasm utilization.

The availability of chemical and other evaluation data we have placed in GRIN, and exposure at the Vth International Safflower Conference held in July, has increased the use of the safflower collection. Specialized seed orders were sent to Akhtar Beg, ICARDA (Iran), Jose Fernandez-Martinez and Leonardo Velesco (Spain), Antonio Corleto (Italy), Enver Esendal (Turkey), Du Lijie (China), Indra Harry (SemBioSys Genetics Inc, Canada, requested core collection).

Core collection development and resulting data for the Kentucky bluegrass collection has increased collection use.

- Extensive utilization of the Agronomic core by Bill Johnston in cooperative projects with RC Johnson has identified elite, high yielding germplasm.

- In cooperation with Shui-Zhang Fei, Assistant Professor, Department of Horticulture, Iowa State University, Ames, Iowa, the RAPD core is being used to determine if chromosome variation might help explain the variation in clustering patterns among Kentucky bluegrass accessions.

Use of lentil recombinant inbred lines (RIL's) by ICARDA:

-We developed RIL's from a cross of the cultivars Red Chief and Crimson. I contacted ICARDA and they were interested in evaluating this material. In 2001, the RIL's were increased and samples sent to ICARDA for cooperative work under the direction of Dr. Ashutosh Sarker.

The RCJ matrices.

While visiting FAO in Rome in 1997 I meet one of the developers of the FAO Ecoport database system (<http://ecoport.org/>). They were wondering how to present numerical information in a logical format so it could be understood and used easily. I made a suggestion to use a simple object by attribute rectangular matrix. Based on this idea, and to my surprise, the RCJ matrix system, using my initials, was started. There are now 272 RCJ matrices in Ecoport. For a list see [http://ecoport.org/EP.exe\\$RCJSearch](http://ecoport.org/EP.exe$RCJSearch)

Organized and lead a program tour of WRPIS for eight Mongolian and Chinese visitors, 6/20-21.

Organized and lead a Post-Conference Tour of WRPIS for the Vth International Safflower Conference. Participants included five Chinese and two Australian scientists, 7/28 to 7/30.

Organized and conducted a station visit for Dr. Devra Jarvis, Senior Scientist, *In Situ* Conservation, Genetic Resources Science and Technology Group, International Plant Genetic Resources Institute (IPGRI), Rome, ITALY, 8/8 to 8/9.

Periodically served as Acting RL as requested.

Research Activities

A. Effective Population Size of Heterogenetic Grass Accessions. Cooperative with Vicki Bradley.

Background. Normally, in a population of N plants, not all are effectively randomly mating, so the effective population size (N_e) is usually less than N . High variation in the number of progeny per plant in a population is a major factor leading to lower N_e and a higher potential for random genetic drift. For samples with equal seeds per plant the variance in seeds per plant is zero, eliminating variation in seed production per plant as a factor lowering N_e . But equalizing the gametic contribution to reproduction and seed balancing is labor intensive and therefore very costly. Heywood (1986) derived the following equation to quantify the proportional reduction in effective population size associated with variation in potential fecundity:

$$1) \quad N_e/N_c = 1 / [(1 + F) (\sigma^2/\mu^2) + 1],$$

where F is the fixation index, and σ and μ the standard deviation and mean of family size. Thus when each parent contributes equally to the gamete pool, σ^2 is zero and $N_e = N_c$. Under these conditions genetic drift is equal to the traditional Wright-Fisher binomial sampling model.

When the variance and mean number of seeds sampled per plant is known then an estimate of

σ^2/μ^2 can be obtained as:

$$2) \quad \sigma^2/\mu^2 \approx s^2/z^2 - 1/z,$$

where s^2 is the variance of seeds per plant in a given population and z is the mean seeds per plant. Seed production of most plants sampled is usually high enough that the correction term, $1/z$, has little effect. Thus, N_e in a population approaches N_c as the seeds per plant variance approaches zero.

Using Heywood's equations, we found that variation in seeds per plant sample reduced N_e/N to an average of 0.73 for annual ryegrass. Thus, in a regeneration population of 100 plants only 73 were on average randomly mating. Much more information is needed on different accessions and species to gain insight into sampling effects genetic drift in our outcrossing accessions. Cost effective sampling methods that maximize N_e need to be developed.

Objectives:

1. Determine the reduction in effective population size, N_e , associated with variation in seed production per plant in three heterogenetic grass species.
2. Determine the utility of inflorescence sampling procedures for a wide range of species and accessions.
3. Compare cutting, rubbing, and inflorescence sampling methods in three grass species to determine effective population size differences.

Objective 1. Determine the reduction in effective population size, N_e , associated with variation in seed production per plant in three heterogenetic grass species.

Progress: This objective has been completed and recently published in CROP SCIENCE. We found reductions in N_e of as much as 60% compared to the census plant population size. This puts accessions at risk for severe genetic drift. Sampling an equal number of inflorescences reduces variation in seeds per plant sampled and increases N_e . Variation in seeds per plant can be further reduced by taking multiple inflorescences per plant. Inflorescence sampling appears to be the cost effective way to improve N_e in regeneration plots.

Objective 2: Determine the utility of inflorescence sampling procedures for a wide range of species and accessions.

The work on N_e in objective 1 showed the need for more plants per grow-out population and that inflorescence sampling is a cost-effective way to even out seeds per plant. These steps will help promote a higher N_e and therefore lower the potential for genetic drift. What is needed now is additional information on how to apply inflorescence sampling to a wider range of species and accessions.

In 2000, two inflorescence samples were taken per plant from regeneration plots on six grass species with four accessions per species at Pullman and at Central Ferry. This will be repeated in 2001. Working with Marc Evans, Program in Statistics, we have developed a statistical model that will allow us to predict the number of inflorescences needed from each plant to maximize N_e . This information can be applied to regeneration programs and also has implications for field collection of germplasm. Preliminary calculations suggest that only a few inflorescences per plant are needed to nearly maximize the positive effect on N_e .

Progress:

2000: sampling was completed for first year

2001: samples from 2000 were cleaned and seed counts completed. A second year of inflorescence field sampling was completed over the summer at Pullman and Central Ferry.

2002: clean samples, finish seed counts, complete calculations to model the number of inflorescences per plant needed to maximize N_e .

Objective 3: Compare cutting, rubbing, and inflorescence sampling methods in three grass species to determine effective population size differences.

The reductions in effective population size for these methods will be examined in field plots at Central Ferry and Pullman with an accession on *Lolium perenne*, *Festuca pratensis*, and *Pseudoroegneria spicata* as model species. Cutting and rubbing are the traditional sampling methods, but how these procedures affect N_e has never been examined.

Cut method: Each plant will be cut with a sickle when the most seeds are mature and each placed in a separate bag.

Rub method: Each plant will be rubbed one or more times as needed and seeds from each plant kept separate.

Inflorescence method: Inflorescences from each plant will be harvested and kept separate. Two will be obtained from each plant.

There will be four replications at each location. Each plot will consist of 30 plants which will be divided into three treatments of 10 plants each. The experimental design is a split block with species as main plots, harvest method as the subplots.

For this study all components contributing to variation in seeds per plant will be assessed and compared. This includes seeds per inflorescence and the number of inflorescences per plant in each set of plants within a plot.

Progress:

2000: Plots for this study were established

2001: Sampling using each method described above was completed.

2002: Finish cleaning and seed processing seeds, make calculations, and complete ANOVA's.

A manuscript will be written combining Objectives 1 and 2 above.

B. Genotyping germplasm collections for duplication and diversity analysis. Cooperative with Ted Kisha and Stephanie Greene.

Background: Molecular markers will have a large impact on germplasm management. They can be used to identify duplicates, develop and test special groups of collections (such as core collections), estimate and compare diversity among countries or regions, and identify acquisition needs. Initially, we are working to refine techniques of characterizing heterogenetic accessions and duplicates. Efficient methods are needed for genotyping heterogenetic accessions and applying data analysis systems that will distinguish accessions at a given probability. As the most efficient techniques are developed, they will be applied to larger germplasm sets.

Objective:

Determine methods for genotyping accessions in heterogenetic species (alfalfa)

Methods:

We are working with three alfalfa accessions each with a duplicate set of cultivar names. In one case for each cultivar we will also be comparing original and increased seed. The material used for this study is given in the table below.

There will be different sampling methods and marker systems used to determine the most effective sampling/marker system combination for genotyping alfalfa. This will be done on the three increased seed populations for each cultivar in the table above. The basic population number per accessions will be 96 plants for the increased seed populations, and 48 plants for the other populations.

Cultivar	PI	Population type	Year acquired
Aragon	279569	increase	1992
	279569	original	1962
	286354	original	1959
	310337	original	1966
Hunter River	286367	increase	1992
	286367	original	1963
	241442	original	1957

	399535	original	1975
	451728	original	1980
Yonca	170535	increase	1987
	170535	original	1949
	170551	original	1948
	171720	original	1948

Marker systems:

Below are four makers systems we can potentially use to compare different sampling methods. Once marker systems are evaluated for efficiency we will choose the most efficient system to examine the entire set of duplicates for each cultivar in the table above.

1. Chloroplast primers. There are two primer pairs developed from the chloroplast genome by Dan Skinner that show considerable variation in alfalfa populations. These appear to be useful to distinguish accessions and duplications.
2. AFLP (Amplified fragment length polymorphisms). This marker system is now being widely used for genotyping work. It has the advantage of being highly reproducible and usually provides numerous markers for each primer pair. The disadvantage is the markers are generally dominant and therefore calculation of factors related to heterozygosity are not possible. But AFLP's provide good genetic distance information. Since these are random marker they don't require the development inputs needed for some marker types.
3. RAPD's (Random amplified polymorphic DNA). These are relatively easy and inexpensive but may be less reproducible as the other markers listed above. We used these successfully for work with the Kentucky bluegrass collection, but they require care in data scoring and in replication of samples to ensure reproducibility.
4. SSR's (Simple sequence repeats). These have the reliability and high number of markers per primer pair that AFLP's provide, and they have the advantage of being co-dominant. In some ways these may be the best marker type for germplasm work to date.

They require significant development inputs beyond what we plan to do, so we are hoping to use primers already developed by others in the alfalfa research community.

Genetic distances will be calculated for each sampling and marker system using a distance (or similarity) coefficient. Statistical procedures will be developed to use in comparing samples. Comparisons will be made among accessions and sampling method to determine if statistical separation is possible, and if so, at what P value.

Agronomic descriptors. This will be completed by Stephanie Greene in Prosser to determine how agronomic factors compare to molecular methods for distinguishing accessions.

Progress:

2000: Plants were established in the green house and extractions started.

2001: All DNA samples were extracted (878 samples). Genotyping was initiated using various marker systems and on increase seed populations. Genetic distances among the increase seed populations were compared for three marker systems. Initial results showed that the chloroplast, RAPD, and AFLP marker systems were all effective in distinguishing

Yonca from Hunter River and Aragon. This was presented in a poster at the CSSA meeting in 2001.

2002: Complete DNA preparation and marker system genotyping on all three of the seed increase populations. Develop statistical approach for comparing populations. Decide on the most efficient marker system and protocol, and proceed with genotyping the duplicate populations. Start drafting a paper on these aspects and complete the marker analysis of duplicates.

C. Evaluation of diverse Kentucky Bluegrass germplasm for seed production in alternative residue management systems.

Background. Kentucky bluegrass (*Poa pratensis* L.) seed production the U.S. is primarily in the states of Washington, Idaho, and Oregon. Traditionally, seed production management practices have included open-field burning after harvest to remove residue and stimulate seed production the following year. A near complete ban on burning Kentucky bluegrass fields has been implemented in Washington State, and the timing and/or the amount of burning are being regulated in Idaho and Oregon. This is causing economic stress in the grass seed production industry. This project is cooperative with Bill Johnston at WSU and has been funded through a USDA Special Grant program for Grass Seed Cropping Systems for a Sustainable Agriculture. The goal is to use molecular and agronomic evaluations to characterize the USDA Kentucky bluegrass collection and identify accessions and/or characteristics that give good turf quality and improved seed production, especially under no-burn residue management systems. The first step was to set up replicated evaluation plots for evaluation of the entire collection. Both agronomic and molecular characterization was completed using these plots and core collections developed based on RAPD and agronomic attributes. Then the agronomic core collection and selections showing agronomic potential were grown in larger plots under different residue management systems to determine the genetic potential for maintaining high seed production on non-thermal management systems.

Objective.

Determine seed production potential of diverse germplasm in burn and alternative residue management systems while evaluating for turf quality.

Progress:

Non-thermal residue management resulted in a sharp decrease in yield on average, as expected. But certain accessions yielded as well when residue was mechanically removed as when burned. Turf quality and yield were negatively correlated, but some accessions with high seed production under non-thermal residue management systems also had reasonably high turf quality. It appeared that the potential for lower turf quality in higher yielding material could be minimized by selection for yield through panicles m⁻². In many cases there appeared to be variation within accessions that may provide improved plant material. As a result, we are initiating a project with elite accessions to study if selection for yield through panicles m⁻² is effective, and how it will affect turf quality.

All data have been collected and analyses completed. A draft manuscript for this work has been written and will be submitted to CROP SCIENCE in 2002.

Talks and Presentations

- Feb. 2-6 Lecture “The National Plant Germplasm System” to class “Plants and society," Horticulture 150. Requested by Rod Tinnemore.
- Mar. 9 Lecture. Crop and Soil Science 445, Plant Breeding, “The National plant Germplasm System.”
- Apr. 27 Presented program for “Join your parents at work day.”
- May 10-11 Presentation and tour for Montessori School of Pullman “Why we conserve seeds.”
- May 17 Lecture “The National Plant Germplasm System” to class “Plants and society," Horticulture 150. Requested by Rod Tinnemore.
- Jun. 23-27 “Evaluation of the USDA Core Safflower Collection for seven quantitative traits.” Keynote Speaker for Germplasm Session at the Vth International Safflower Conference, Williston ND.
- Jun. 23-27 “International Safflower Germplasm Committee Report”, Vth International Safflower Conference, Williston ND.
- Oct. 2 “Improving effective population size during grass seed regeneration.” (Poster) Crop Science Society of America National Meetings, Charlotte, NC.
- Dec. 3-7 Class lectures “Plant Genetic Resources” for Hort. 150 “Plants and Society, Washington State University.”

Travel, Invitations, Special Awards and/or Assignments

- Jun.1 Elected as Crop Science Society of America Fellow and Elected as American Society of Agronomy Fellow. These are the highest awards given by the Societies.
- Jul. 23-27 Participant at the Vth International Safflower Conference, Williston, North Dakota, Sidney, Montana, USA. Activities included:
 - Served on the Organizing Committee
 - Co-Editor of the Vth International Safflower Conference Proceedings, reviewed ten manuscripts and three abstracts for the proceedings
 - Wrote six letters of invitation for Chinese Scientists to obtain Visas to attend

- Chaired International Safflower Workshop
- Keynote paper in Germplasm Session
- Asked to serve on the International Safflower Continuing Committee for future meetings
- Asked to serve on International Research and Development Committee
- Oct. 21-25 Participant at the Crop Science Society of America National Meetings, Charlotte, NC. Activities included:
 - Reported to Forage and Turf CGC concerning Argentina collection trip
 - Presented poster paper (senior author)
 - Co-author on three additional posters
 - Received ASA and CSSA Fellow awards
 - Presiding Office for symposium “Plant exploration: Adding to our global treasures” session II.
- Nov. 29 As member of the Technical Advisory Committee, attended the Grass Seed Cropping for a Sustainable Agriculture annual meeting, Moscow ID.
- Nov. 31 Participant at “Intermountain Native Plant Summit,” Boise ID. Represented the NPGS and wrote portions of ARS section for the report to Congress titled “Interagency Program to Supply and Manage Native Plant Material for Restoration and Rehabilitation on Federal Lands.”

Committees, Other Assignments, Activities and News

Ex-officio member:

Alfalfa CGC.

Forage and Turf Grass CGC

Chair, International Safflower Germplasm Committee (1997-2001).

Member of the Technical Advisory Committee for the Grass Seed Cropping Systems for a Sustainable Agriculture Special Grant Program.

Secretary (2001), Grass Breeders Work Planning Conference. Will host National Conference in May 2001 and become Vice-Chair (2002), and Chair (2003).

2001 C-8 Awards Committee for outstanding papers in genetic resources. Involves reading all Division C-8 papers for a given year and nominating the top three for awards.

Served on MS Graduate Committee for Pamela Scheinost, Department of Crop and Soil Sciences, WSU.

Served on MS Graduate Committee for Grant Poole, Department of Crop and Soil Sciences, WSU.

Member of International Research & Development Committee for the International Safflower Conference.

Member International Scientific Committee for the Second International Conference on Sustainable Agriculture for Food, Energy and Industry, to be held in Beijing, China., 9/02.

Asked to serve on the National Sunflower Variety Review Board by Vivien G. Allen, CSSA President -Elect, four year term from 2001-2005 (Declined) 9/25/01.

Invited to Workshop on invasive weeds sponsored by the Missouri Botanical Garden, Kew, and American Association of Botanical Gardens and Arboreta (1-4 December 2001) by Peter Raven, Director, Missouri Botanical Garden, 9/24/01 (Declined).

Cooperator with Bill Johnston and Jerry Sitton on the project entitled "Disease control in bluegrass cropping systems without open-filed burning."

Member of Graduate Faculty, WSU

Journal peer reviews (4), ARS peer reviews (4), Crop & Soil Sciences peer reviews (1).

Plans for 2002

Continuing research:

1. Determine the reduction in effective population size, N_e , associated with variation in seed production per plant in heterogenetic grass species and develop improved sampling techniques. (Cooperative with Vicki Bradley)
2. Use molecular markers to genotype accessions, identify duplicates, and characterize germplasm collections, initially in alfalfa (cooperative with Stephanie Greene and Ted Kisha).

New research:

1. Selecting high yielding Kentucky bluegrass for non-thermal management (Cooperative with Bill Johnston)
2. Production of high and low water use efficient Tall Fescue germplasm (Cooperative with Andy Hopkins at the Noble Foundation, Ardmore, OK)
3. Evaluation for winter hardy safflower (Cooperative with Vicki Bradley)

Writing to be completed for 2002:

1. Johnson, R.C. Comparison of agronomic and biochemical traits in balanced and bulked populations of annual ryegrass population after three regeneration cycles. Submit to THEORETICAL AND APPLIED GENETICS.
2. Johnson, R.C, W.J. Johnston, C.T. Golob. Evaluation of diverse germplasm for seed production under contrasting residue management. Submit to CROP SCIENCE.

Plans for 2002

1. Serve as ARS representative in the National Program Review and Turf grass Workshop, 22-25 Jan., Dallas TX.
2. Presentation to Second International Conference on Sustainable Agriculture for Food, energy, and industry, Beijing, China, 8-13 September (invited, expenses paid).
3. Participant in the Crop Science Society of America National Meetings, present paper(s), 10-14 Nov., Indianapolis, IN.
4. Collect grass germplasm in Northern Russia with R. Hannan in August. Continue working toward germplasm exchange and evaluation of South American grasses with G. Becker in Patagonia, Argentina.

5. Continue supervision of agronomy research program and genetics lab. The goal is to develop the genetics lab into a productive station resource for germplasm characterization complementary to other programs.
6. Work with curators as requested to advise on program needs, regeneration procedures and evaluation.
7. Continue as member, International Safflower Germplasm Committee and Research & Development Committee.
8. Continue to serve on Technical Advisory Committee for the Grass Seed Cropping Systems for a Sustainable Agriculture Special Grant Program.
9. Continue to serve as Ex-officio member:
 - Alfalfa CGC.
 - Forage and Turf Grass CGC.
10. Continue cooperative project to regenerate wild safflower accessions with José Fernández-Martínez, oilcrops geneticist and breeder of the Instituto de Agricultura Sostenible CSIC, Córdoba, Spain.

MOLECULAR GENETICS LABORATORY (T. Kisha)

Research Activities

- A. Molecular marker characterization of synthetic populations and obligate outcrossing species continued.
 1. Completed chloroplast marker PCR and analysis
 2. Completed RAPD marker analysis
 3. Established procedures for AFLP marker analysis. Began marker analysis.
- B. Established and applied procedures for marker analysis using GeneImager software.
- C. Edited AFLP procedures resulting in cost savings of more than 50% over vendor recommended procedures. Reduced reaction volumes for Restriction and ligation reactions from 25 μ l to 12.5 μ l, preamplification reaction volumes from 25 μ l to 10 μ l, and selective amplification volumes from 25 μ l to 10 μ l. Additionally, introduced a time-saving procedure which maintained a 96 well format and automated DNA sample restriction and ligation. This also improved accuracy of all analyses by reducing the number of steps where samples could be accidentally mixed.
- D. Established procedures for AFLP gel preparation using LiCor KB+ products and Gel Company paper comb loading of samples to increase success and uniformity among AFLP runs.
- E. Trained laboratory personnel and assisted research scientists:
 1. Connie Foiles – PCR, AFLP
 2. Ann Lutes – DNA Extraction, RAPD, Fluorometric DNA analysis, general

- lab procedures
3. Rena Fabre - Fluorometric DNA analysis
 4. Steve Clement/Leslie Elbersen – DNA Extraction
 5. Vicky Bradley - DNA Extraction
- F. Continued renovation of Lab 35:
Millipore water Purification System
FOTODyne Gel Image Archiver
Thermocycler: GeneAmp 9700
- G. Investigated methods of high throughput DNA extraction for 96-well format. Working on implementing procedures at improved cost savings.

Talks and Presentations

- Oct. 15 Presented seminar to the Plant Pathology Department of WSU entitled, “Evaluation of Wheat for Resistance to Glume Blotch (*Stagonospora nodorum*) Using Detached Leaves and Spikelets.”
- Oct. 22-25 Presented poster at the CSSA meetings in Charlotte, NC: Comparison of Molecular Marker Types for Characterization of Alfalfa Accessions.

Travel, Invitations, special awards and/or assignments

- Jan. 10-11 CSSA Renaissance Initiative Conference, San Diego, CA (Invitation)
Recommended procedures for improving the content and format of CSSA Annual meetings and increasing membership in the society.
- Jan. 13-18 Plant & Animal Genome Conference IX, San Diego, CA
- Oct. 21-25 ASA-CSSA-SSSA Meetings in Charlotte, NC (Volunteered Poster Presentation)
- Oct. 29-31 New Scientist Orientation, Albany, CA (Presented Poster on current research)

Committees, Training, Other Assignments, Activities, and News

- Member, CSSA Renaissance Committee (2001).
- Feb. 7 Attended in-house purchase card training.
- Feb. 24 Arranged for and hosted a seminar by John Gripp (LiCor sales representative) for the introduction of the new Odyssey imaging system.
- Apr. 17 Attended a workshop on the Quiagen robotics system at the University of Idaho.
- Jun. 21 Conducted laboratory tour for Chinese visitors. Demonstrated DNA extraction procedures, PCR, RAPD, and Automated AFLP procedures.
- Jun. 27 Attended a workshop entitled, “Exploring the interfaces between computer science and molecular biology.”

- Jun. 28-29 Attended a workshop entitled, "Microarray Analysis."
- Aug. 7 Attended the Science Product Show and established contact with Promega representative for demonstration and evaluation of MagnaSil DNA extraction kits. Also arranged for LiCor representative to visit and reconcile non-compatibility of GeneImager software with upgrade of AFLP imaging equipment.
- Sep.6 Arranged for demonstration by Qiagen, Beckman and TECAN (Robotics selection committee).
- Sep. 25-27 Arranged for and attended workshop: LiCor Automated sequencer problems. LiCor conceded that I was correct with regard to their GeneImager software would not work with the equipment upgrade and we received a new GeneImager upgrade.
- Oct. 4 Attended workshop entitled, "Light Cyclor, Real-time PCR."
- Nov. 28 Conducted a high school science class tour of the laboratory. Demonstrated DNA extraction, visualization, quantification and analysis.
- Dec. 19 Arranged for a demonstration by Promega rep of Magnasil DNA Extraction Procedures. Conducted further tests on the paramagnetic beads to determine DNA saturation point of the particles and repeatability and variability of DNA extraction with known particle content. Will incorporate this extraction procedure into our lab (\$1.70 per sample/96 samples in 4 hours).

Plans for 2002

I plan to pursue research project discussions that I have already initiated with the following individuals:

- Linda Hardesty/Mark Stannard – Evaluation of Reed Canary Grass Populations
- Barb Hellier – Evaluation of Licorice accessions
- Ann Blount – Evaluation of Bahai Grass accessions for adaptation to cool season production
- Vicky Bradley – Evaluation of Safflower accessions
- Vicky Bradley – Evaluation of duplicate accessions of grasses

Computer and Safety (G. Pentecost)

Activities

Computer Resources

The use of computers requires an on-going effort to keep up with technological advances. Updating and upgrading the group's computers continued to be one of my main goals this year. Although industry standards call for a replacement cycle of three years, our computers have been meeting our needs over a longer window of time. This has been a result of evaluating individuals' needs and directing resources accordingly. For example, people with highly

intensive applications need more robust computers than people who mostly perform basic document and spread sheet operations.

Improvements were accomplished in three ways. First, we purchased new computers to replace some older models. Next, we cleaned up the best of the replaced computers and passed them on to people with even older machines. Finally, we increased the performance of our intermediate computers by adding additional memory. Efficient use of our resources and competitive pricing in the marketplace led to reduced computer costs this year.

Getting rid of unwanted computers became difficult because of the metals and other toxic materials they contain. To resolve this, we transferred the unneeded computers to a recycling company that reuses functional machines and disposes of unusable computers in an environmentally responsible manner.

During 2001, we started to investigate the benefits of GIS (Geographic Information Systems) for collection trips and accession management. To begin, we inquired about existing applications and software choices at other ARS locations. The USDA decided to standardize on ESRI GIS software this year. Fortunately, we were able to take advantage of the Washington State University site license that allowed installation of the ESRI GIS software package on our computers. In December, we decided to launch a pilot project centered on an upcoming collecting trip. The goals will be to develop maps that will help participants choose collecting sites more efficiently, and to concurrently update information in GRIN for existing accessions from the same region.

More people took photographs with our digital camera this past year. The demand created a need for a second digital camera. Both cameras were used to track project progress, document the condition of plants, and take accession photos for GRIN. The Imaging PC we purchased in 2000 was increasingly popular for image manipulation and data backups. Group personnel downloaded, edited and printed digital photographs from the cameras; scanned slides, photos, and documents; and discovered the advantages of backing up their data with the CD burner.

The WRPIS web site is a dynamic assignment that required continuing updates. I added reports, revised the main page, refined the links, and updated staff information and personal pages. I also collaborated with the developer of the Prosser web site.

Computer Security

Like last year, computer security required constant attention. We detected a major increase in the number of attempts to infect our computers, primarily through email attachments.

Our preventative efforts required a number of measures. These measures included replacing computers that were too slow to run the latest anti-virus software, installing the latest anti-virus software whenever it was upgraded, and updating it frequently. Security-related newsletters and mailing lists delivered prompt warnings about particular threats. I repeatedly emphasized best

practices concerning email attachments, passwords, data backups and shared directories. We reduced the use of problematic software, installed software that blocked the most common method of infection, and responded quickly to incidents.

Group personnel have taken the threats seriously and adapted to a more defensive environment. As a result, our efforts were quite effective. Computer security options were somewhat governed by being part of Washington State University network. Recent campus-wide steps taken by the University computer staff appear to have reduced the incidence of attacks on individual machines.

Safety Awareness

Two important parts of a safety program are meeting employee training requirements and dealing with unique issues.

To facilitate employee education, I announced training sessions, arranged retraining for people whose first aid cards were about to expire, gathered materials on topics that enhanced the WPS (Worker Protection Standard) training, and tried to expedite OMSP (Occupational Medical Surveillance Program) participation for our licensed pesticide applicators.

Several unique issues were successfully concluded or clarified. After extensive efforts by local and regional safety personnel, we were finally able to get our non-compliant eyewash stations replaced. The tires on one of our most heavily used vehicles had become seriously worn, so we got them replaced by the state motor pool. Questions to WSU Facilities Management about water quality led to the discovery that none of the water in our greenhouses, labs or break room is potable. As a result, we now have bottled water available at all affected facilities.

In October, the OIG (Office of the Inspector General) sent an inspection team to look at ARS facilities at WSU in regards to toxic chemicals, biohazards, chemical inventories, and emergency response plans. We prepared thoroughly for their visit, and the inspection went well. The OIG team did not find anything we needed to follow up on.

Talks and Presentations

I gave brief presentations on the most important safety and computer-related issues at our Plant Introduction group meetings.

Travel, Invitations, Special Awards and/or Assignments

- May 21 - 23 Received training from Robert Webster on the use of his GIS that determines plant exploration criteria.
- Jul. 11 - 12 Traveled to Prosser, Washington to demonstrate Robert Webster's GIS analytical process.

- Oct. 9 - 10 Attended a course in Spokane, Washington, on “Troubleshooting, Maintaining & Upgrading PCs,” presented by CompuMaster.
- Nov. 8 Attended a seminar in Spokane, Washington, on “Exploring ArcView 8.1,” presented by ESRI representatives.

Committees, Other Assignments, Activities and News

Washington State University CAHE Safety Committee

ARS Pullman Location Safety Committee

Member of session development team for ARS National Area Office Conference

Attended WSU classes on PowerPoint and Web Content Accessibility (Section 508).

Attended a workshop on “Conflict Management” presented by WSU Human Resource Services

Completed ARS training on Ethics, Security Awareness, and Credit Card Usage.

Plans 2002

1. Web site

Continue to develop the web site for the WRPIS station in Parlier.

Refine the Pullman web site so that it meets Section 508 accessibility standards.

2. GIS

Develop maps based on criteria specified by the collecting team that will assist their efforts.

Gather unrecorded accession data about those same plant lines for GRIN updates.

3. Attend additional training in the areas of computer support and safety awareness.

4. Continue emphasizing good PC security practices within the group.

SEED STORAGE & GERMINATION LABORATORY (D. Stout, P. Lundt, M. Nelson)

Activities

By the end of the year, 756 orders were complete. A total of 595 orders were filled which included 11,589 accessions in 17,072 packets. NCGRP was sent 693 accessions. A total of 75,654 new observation records were added to GRIN on 21 crops and 158 descriptors. Twenty-seven percent of the new observations came from WRPIS. A total of 3,280 viability records were added to GRIN on 62 genera and of these, seventy-nine percent were entered by Paula Lundt. Seed numbers were determined on 10,207 inventory lots.

Sub-samples and regeneration packets were made on the lettuce collection and packaged in sealed waterproof packets and is ready to store in the -10C storage.

The cold storage room was reorganized so the grass drawers are now in order by taxonomy.

Research Activities

An experiment was conducted to determine if field emergence could be used to replace laboratory germination's. One hundred accessions per crop were randomly selected on *Phaseolus vulgaris*, *Cicer arietinum*, *Lens culinaris* and *Pisum sativum*. Two reps of 30 beans seeds, 40 Cicer seeds, 100 Pisum seeds and 100 Lens seeds were planted at Whitlow farms, Pullman Wa. on May 21, 2001. Seed was treated with Captan before planting. These same accessions were germinated using ASOA rules in a germinator.

Results are:

	Beans	<i>Cicer</i>	<i>Lens</i>	Peas
Average field %	81	84	70	69
Highest field %	100	99	93	79
Lowest field %	7	56	38	39
Std. Dev. Field	16.9	7.0	11.0	7.4
Average Lab %	96	95	96	96
Highest Lab %	100	100	100	100
Lowest Lab %	59	33	70	88
Std. Dev. Lab	7.1	10.1	5.6	3.3
Average Lab-field %	14	10	25	27
Highest Lab-field %	93	27	62	59
Lowest Lab-field %	-15	-31	-1	13
Std. Dev. Lab-field	17.6	8.1	11.9	8.2

Discussion:

The Lab germination average was enough higher in all four crops to discontinue field emergence as a form of determining germination percentage. Eleven had higher field emergence than Lab. germination and most of those were only slightly different, except one which was 31% different, and I think that was a field planting planter error. The extra time needed for field planting such as making field stakes and field land preparation was offset by not having to wash the lab petri dishes, but treating the seed did make the field emergence method more time consuming.

These four crops show little dormancy, but *Pisum* and *Cicer* do have hard seed coats on occasion and field planting make it hard to identify dormancy. Another disadvantage of the field emergence method is one bean accession that was a late emergence took weeks to come up and there wasn't a way to know that when seeds are in the soil. Counting field emergent could be

used as an indicator to do Lab germinations on the results that are low. Good field emergence meant good lab germination, but not visa-versa.

Talks and Presentations

Apr. 11 Kiawanis club in Spokane, lunchtime talk about WRPIS
May 15 Lions club in Spokane, lunchtime talk about WRPIS

Plans for 2002

1. Continue packaging seed into sealed waterproof packets for -10C storage.
2. Attend GRIN meetings in Beltsville to update GRIN to mouse driven software.
3. Continue germinating newly increased inventory lots as they arrive.
4. Continue updating crop descriptors and codes to a more systematic spelling.

PULLMAN FARM OPERATIONS (W. Olson, S. McGee)

Activities

As planned, we expanded the use of the mechanical transplanter throughout the entire lettuce program under Barbara Hellier. This worked very well for precision transplanting with the lettuce in regard to spacing, depth, speed, and transplant survival. Instead of using the transplanter system in a side-by-side configuration as with the grasses, we effectively used only one side of the transplanter for single row planting.

We used the mechanical transplanter for Clare Coyne's lupine program and the results were equally as good. For the lupine program in which the accessions have to be caged to prevent cross-pollination, we used the transplanter in close, side-by-side double pass operation. This worked well with a little hand planting to get the needed number of plants into the cage areas.

In Vicki Bradley's grass program, change in 2001 was very dramatic. After preliminary research Vicki and Bob Guenther decided to switch to a "cone-type" plug in foam flats instead of the band and tray system that has been used by WRPIS for years. The advantages to mechanical transplanting included: 1) not having to take days to place bands into the flats, 2) not having to deal with the bands at planting time, 3) the square bottomed bands would plant at different depths through the mechanical transplanter depending on whether they were placed in the cup straight up and down or if they dropped sideways by accident, 4) less volume of planting mix (soil); and, 5) closer configuration of the plug to the cup for more uniform planting. In addition, they changed from a soil / sand / peat mix which had to be autoclaved, to a Sunshine #5 Plug Mix. This saved time, money and labor and resulted in safer working conditions in the middle of winter on the

Farm. Also, they changed from planting in the banded flats and thinning multiple times to germinating the grasses in germination boxes and planting one very small plant per plug in the “cone-type” flats. This, though tedious work, was much more time and cost efficient than the previous system. With these changes, accuracy of plant population control and plant vigor went up dramatically in 2001.

We finished modification and retrofit procedures on the old “Cone Drill”. The original drill consisted of a seat, a ground powered bell, a single planting disk and a “cone” which resembled a large funnel. Planting had been done by “dribbling” seed through the “cone” and into the disk from one bell ring to another, but this method did not provide adequate precision for within row spacing of seed. The “cone and bell” system was replaced by the farm crew with a new Hege small seed distribution cone and a Zero-Max distance controller. The exact sprocketing for the correct gear ratio from the new tires to the Zero-Max was a challenge to engineer, but it was quite apparent from the first day of operation in the field we made the right calculations and decisions. This change in our direct seeding system provided accuracy precision drilling and time efficiency. When we started looking at testing / using the modified drill in 2001, we were thinking peas and lentils. In fact we seeded peas, lentils, beans, grasses, chickpeas, safflower, and more with this little drill that fits behind one of the smallest Kabota tractors made with a 3-point hitch. This little compact drill will be a mainstay in 2002 crop production plans for direct seeding.

The new potting shed for the Pullman station turned out to be a very drawn out, but worthy assignment. Though given the keys at the end of January 2001, the interior walls were only studs, insulation, and plastic sheeting and the water went to the hot water tank and that was it. We worked whenever we could find time throughout the spring and summer to finish the shed. Considering our field and farm workload this year, and with many of the curators and researchers increasing the number and size of their accessions, completing the shed took until November 13th to finish the plumbing. On November 15th the first pots were cleaned in the building. For the station, my staff, and myself it took a lot of patience to see this project through to completion this year. William Luna, the Greenhouse technician, is now pulling together the entire greenhouse operation’s inventory stored throughout our system and stocking the new building to meet today and tomorrow’s needs for our curators and researchers. This will decrease inventory replication we have had up to this time and increase efficacy of some of our future labor requirements in our greenhouse system. William is finishing development of the pot cleaning SOP (Standard Operating Procedure) for an even flow of dirty and clean pots by the thousands through this facility. The time and energy this project has taken this year has well been worth it.

As for the monitoring of the particulate matter in the cleaning room, we have received a new air filtration unit that will be a great asset when installed. Beyond that, I’ll leave further comment to our Seed Conditioning technician, Dan Cervantes.

Last year we did a fall beet planting with Alan Hodgdon to see if the stretch wrap configuration on the cold frames would make a difference in winter hardiness.. Whatever the cold winter winds did not tear up and blow away, the vole population ate up even though we baited each of the cold frames throughout the winter. A completely different structure was designed by my farm technician, Scott McGee, in cooperation with Dr. Richard Hannan and Kurt Tetrick (Farm

Manager at Central Ferry) that is looking very respectable up to this point.

In the spring a new surface drip irrigation system was installed on the Observatory Hill farm. This simple system has worked well for establishment and maintenance of the chickpea collections throughout this year. The beauty of the system has been the ease of expansion when needed as we have brought new accessions into the field.

Looking down through the year of 2001, Scott McGee and I finished the remodel of Greenhouse 44 B around the first part of January. This rebuild started with an unlit greenhouse with wooden boards on sawhorses for benches and an uneven gravel floor. We started with a complete clean out of the house and a new layer of fine gravel on the floor for leveling and compacting. Next, a covering of fabric ground cover was laid to finish the floor and lastly metal benches were placed at 15 inches in height. The finishing touches were a new pot by pot automated irrigation system and a "blended light" system with a grid of 400 watt P/L lights and 400 watt Metal Halide Lights. The result was an excellent facility with very enhanced ability for plant growth compared to the facility we started with.

We then renovated the light system in five (5) Bays of Greenhouse #3 which is one of the oldest greenhouses in the WSU system. We helped Russell Staska finish up putting in a "blended light" of high-pressure sodium lights and metal halide lights. We then built the suspension brackets for the horizontal airflow fans (HAF) installed to manufacturer specifications. In visiting with Barbara and Russ later, this HAF system has dramatically decreased the occurrence of diseases and increased the vigor of plant growth within their greenhouse bays.

Changes in Use of Student Help

Toward the end of February we worked Career Days for the first time at the University of Idaho which yielded two (2) good students for summer help and good public relations for Plant Introduction and USDA-ARS in general. In the past each curator or researcher each had their own stock of summer student help.

This year Dr. Rich Hannan initiated pooling of summer student help under the farm operations. Basically the curators and researchers did have one or possibly two summer students as their program required, and a core group of six (6) students worked field maintenance with the farm crew. These students were then split off to the curators or researchers as needed on a day to day basis, or used for general farm field maintenance if no specific labor was needed for the day. Three (3) days a week these students were at the Pullman farm and two (2) days a week the students were at the Central Ferry farm. A high amount of communication was needed to make this system work, but the net result was an increase in efficiency of the Pullman Station labor in the summer of 2001 compared to previous years.

Travel, Invitations, Special Awards and / or Assignments

Jan. 31- Wayne, Scott, William attended the Eastern Washington Ag Recertification
Feb. 1 Courses at the University Inn. Best Western in Moscow, Idaho

- Feb. 2 Wayne Olson attended the Annual Wilbur-Ellis Ag Chemical Education and update series at the University Inn / Best Western in Moscow, Idaho.
- Feb. 26 Wayne, Scott, William worked the University of Idaho Ag Career Days in conjunction with Pam Dean to represent USDA-ARS in the University of Idaho and WSU Regions.
- May 31 Wayne, Scott, William attended USDA's annual respirator training and fit test for pesticide users and applicators.
- Jun. 26 Wayne Olson attended the University of Idaho Annual Parker Farm tour in Moscow, Idaho which showcases research in new crop advances and soil conservation practices.
- Nov. 28-29 Scott McGee traveled to Pasco, Washington to attend the Pacific Northwest Vegetable Association Annual Conference and Trade Show.
- Dec. 11-12 Wayne Olson traveled to Spokane, Washington for the Far West Ag Chemical and Fertilizer Association Meetings and Trade Show covering crop fertility, pesticide use, and new Ag Chemical Regulations for 2002.

Committees, Training, Other Assignments, Activities and News

- Sept. 13 Dan Cervantes, Scott McGee, and William Luna started attendance to the Washington Through State University's Leadership Development Series. This 40-hour course covers all aspects Spring Of Leadership Development including, but not limited to: Employment Policies, Safety, Semester Sexual Harassment Prevention, Diversity, Coaching, Problem Solving, Conflict Management, Discipline, Delegation, and many other aspects and areas related to working within the University system.

Plans for 2002

1. Modification of the Mechanical Transplanter for better accuracy in planting depth for different crops.
2. Modification of the Small Plot Cone Drill for easy conversion from a single row planter to a two row planter.
3. Modification of the small farm sprayers (2) for the Kabota tractors to electric pumps and cone bottom tanks for easier sprayer calibration, cleaning, and rate conversion when needed.
4. A possible construction of a new seed cleaning room here on the farm.
5. We look forward to the installation of the new air filtration system that we just received into the seed cleaning facilities.
6. We added close to 25% to our acreage that we manage here at the Pullman Farms for crops and crop rotations in the year of 2001 with the addition of Lower Whitlow, Fields 2 and 2A of the Plant Materials Farms, and Field 2 of Observatory Hill. With our curators and researchers still expanding their programs, we will be required to have additional acreage in place for 2003 for expansion of germplasm regeneration. We face the

possibility of losing the whole Whitlow Farm in 2003 through WSU negotiations with the Moscow / Pullman Airport. This has us evaluating alternatives for land at this time.

7. We are looking to start pollination of crops with bees inside insect proof tents to increase seed yields in 2002. Over the years we have done tenting for insect exclusion, but this will add a whole new dimension to the Pullman Plant Introduction Station's program.
8. We are looking to follow through with the fall beet plantings we established in the fall of 2001 and take them through production depending on the crop's over-wintering capabilities in the newly designed cold frames.
9. Gwen Pentecost and the Farm Group started looking into GPS possibilities for the Pullman Farm to help track and record accession locations and dimensions. This we look to move further into in 2002.

SEED CLEANING (D. Cervantes)

Early in the year, the seed-conditioning program was dedicated to finishing the 2000 Pullman and Central Ferry grass crops. The grass crops were completed in February and the horticultural crops were started. The program cleaned the horticultural crops, although extensive and diverse, by the middle of March. For the seed-conditioning program this was a great accomplishment. This year I was involved in more farm practices earlier in the spring, because the crops were cleaned effectively and efficiently early on in the year.

Beets, beans, lettuce and other glasshouse-grown crops are cleaned on an as needed basis throughout the year. After harvest the crops are dried and prepared for cleaning. Cleaning of the crops is only started once the crops have dried in the drying shed. The cleaning program began to clean field and or screenhouse crops in June. A Vogel machine, equipped with two rubber drums, was used to thresh the peas. Also in June, all recently used harvest bags were cleaned and inventoried with existing stocks.

In late July the rubber drum Vogel machine was transported to Central Ferry to be used to thresh the field-grown pea, lentil, and chickpea accessions. In early August, the threshing of the cool season legume crops were completed and the Vogel thresher was transferred back to Pullman. Once back in Pullman, the machine was used to thresh the lentils, peas and chickpeas from the greenhouses and the field.

The safflower crop in Central Ferry was ready to harvest and thresh in early September. Threshing of this crop includes the use of a different Vogel machine, a spike-tooth. In addition to the safflower, the balance of September was dedicated to cleaning the garlic as well as finishing the safflower later in the month.

October was dedicated to finishing the cool season legume crops and to prepare for the cleaning of the grasses. The harvest bags for the grasses were all organized and placed into the storage room adjacent to the cleaning room. October 22 brought the starting of the cleaning process for

the grasses. From October to the end of the year was dedicated to cleaning the grass crops.

The particulate matter in the cleaning room was not monitored this year. The technician that was going to monitor the room arrived after all the grasses had been cleaned. In spite of this the seed-conditioning program purchased and received a new air filtration system. The filtration system will provide continuous dust collection from the four machines as well as a floor sweep. The system will be located on the outside of the building, hence not using valuable space in the processing room. The new filtration system will allow the room to have continuous airflow in and out; this will reduce energy costs in heating the room. .

Overall a very productive year, the crops were cleaned more efficiently than the previous year. Since I took on more tasks this year the grass crops were started a bit late this year. However, I foresee the grasses being finished in February, similar to 2001. While this was my first full year of work I feel the seed-conditioning program, which included Scott McGee, temporary student help and myself, was successful in cleaning all the crops with veteran-like excellence and plenty of fun.

Travel, Invitations, Special Awards and / or Assignments

Jan. 30 - Feb 1	Attended the Eastern Washington Ag Education and Testing at the University Inn / Best Western in Moscow, Idaho. Dan passed and received his Washington State Public Operator Pesticide License.
Feb. 26	Worked the University of Idaho Ag Career Days in conjunction with Pam Dean to represent USDA-ARS in the University of Idaho and WSU Regions.
May 31	Attended USDA's annual respirator training and fit test for pesticide users and applicators.
Nov. 29-30	Attended the Northwest Futurama Seed Technology Showcase in Boise, Idaho. The trade show and meetings covered advances and equipment for seed cleaning technology.

Committees, Training, Other Assignments, Activities and News

Sept. 13 to Spring	Started attendance to the Washington State University's Leadership Development Series. This 40-hour course covers all aspects of Leadership Development including, but not limited to: Employment Policies, Safety, Semester Sexual Harassment Prevention, Diversity, Coaching, Problem Solving, Conflict Management, Discipline, Delegation, and many other aspects and areas related to working within the University system.
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CENTRAL FERRY FARM OPERATIONS (K. Tetrick)

Activities and Improvements

Germplasm increases at the Central Ferry Research Farm included: .25 acre of peas and .5 acre of chickpeas for Clare Coyne's program research; a total of one acre in several locations for isolation of alliums, leeks and lettuce for Barbara Hellier's research; one acre of safflower, 19 acres for the 2000-2001 grass nursery and 22 acres for the 2001-2002 grass nursery for Vicki Bradley's program. The amount of land used for grass nurseries is to accommodate isolation. The actual nurseries themselves were three acres each); and , there were 64 lines of each bean, greenhouse and three crops for Molly Welsh's *Phaseolus* program. In January we built a shade for the large pump out of metal framing and roofing. We also replaced the florescent lights in the shop with metal halide lights that improved the lighting for working on, around, in, and under the equipment.

The irrigation system has been upgraded with timers so that it will function automatically. This has helped us monitor our moisture and reset the intervals accurately and precisely. We decreased the thickness of the plastic for the grass transplanter. The thinner plastic allowed the mechanical transplanter to punch through better. However, the thinner plastic was not able to take the abuse this summer and it will be difficult to recover. A drip tape barrier was purchased and is now ready to bury tape six inches deep as we plant or lay plastic. It was determined that we will need to bury tape deeper than three inches because of hoeing damage. I found I cannot reuse tape because of pinholes from recovering and re-laying tape. The tape layer has been a great time saver and a good irrigation method for putting the water at the root zone. In the future I hope to inject fertilizer into the individual manifolds to reduce the amount used from broadcast fertility.

We began injecting infuric acid for hard water problems and copper sulfate for algae. When I designed the system I didn't think of clear/white tanks leading to algae. We tried injecting product at 1 to 10 ppm to reduce or eliminate the problem but found we needed black tanks. We will still inject infuric acid to reduce the hard water scale inside the tanks and filters after the new tanks are installed.

The Central Ferry area of Garfield County has been seeing a growing population of mule deer in the past five years. We are experiencing a problem with the increased deer population because during the late summer and early fall months after the pasture and wheat crops die down Central Ferry is still green. Central Ferry incurred significant deer foraging damage to cover crops, safflower, specific grass lines, and ornamental nursery plants. We also experienced destruction of peas and chickpeas. We have tried electric fencing with aluminum foil and peanut butter hanging from the fence, which worked for a 24-hour period, but the fencing was destroyed after deer walked through it. We used whistler rounds shot from a 12 gauge shot gun, but this didn't work either. The only answer was an exclusion fence around the whole farm. After discussing the options with outside industry and our departmental personnel we began building a 1.6 mile, 8 ft. "tight lock" game fence. We began burying the old hog wire from the old fence a foot in the ground and hog ringing the wire to the bottom of the game fence. This will prevent animals from digging under the fence. It will also allow us to leave the cattle guards and should there be a

problem, we will build deterrents.

Visitors

Along with the international touring groups that tour all of plant introduction one other person took a look at the Central Ferry Farm from New Zealand. Hugh Ritchie of Drumpeel Partnership was touring the United States studying irrigation, minimum tillage, and no till. Mr. Ritchie was touring under a Nuffield Farming Scholarship.

Research Activities

Research activities included: a three acre chickpea core collection evaluation by Clare Coyne; research on the ornamental aspects of 80 lines of safflower by Vicki Bradley; research on lentils by Richard Johnson; and perennial grass insect resistance by Stephen Clement.

Kim Campbell, USDA Wheat Genetics, used two acres for club wheat breeding; Steven Jones used one acre for his winter wheat breeding project; David Bragg, WSU extension (Garfield County), work on pesticide research with winter wheat and canola; Mark Nelson, WSU Prosser, investigated hops pathology, fungicide work for powdery mildew in hops on two and one-half acres; and, Robert Thornton, WSU Horticulture, used three acres for his early generation potato selection research. Many of these research projects are at the Central Ferry farm because of its isolation from similar crops grown on the farm.

Temporary staffing

Frank Phillips Jr. worked for us from April 03 to September 30,2001. A very helpful, positive and hard working person. Frank was a great asset for my projects and field maintenance schedules.

Brandon Morgan worked for us from June through late August. Brandon did a good job with direction from staff.

Plans for 2002

Irrigation:

Constructing fertility injection carts that will be towed by our four wheeler to the manifolds.
Improve upon the plastic mulch system

Buildings

More building improvements if time and funds allow.
Gravel the floor in the greenhouse for better drainage and improve the irrigation system.

Work with the curators and research staff while their projects are located at the Central Ferry Research Farm.

GREENHOUSE OPERATIONS (W. Luna)

Activities

The greenhouse management program is one year old. The priority of this program is to help maintain plant health in the units' greenhouses so that seed production is optimized. This is accomplished through pest control, soil preparation, and greenhouse maintenance. The program is responsible for maintaining greenhouse pesticide inventory and also oversees weekend and holiday watering.

In 2001, the new greenhouse operations shed was completed. This facility allows the station to take advantage of a centralized location for storing greenhouse supplies such as clean pots, root trainers, potting labels and bags of premix soil. The building serves as the location to wash dirty pots. It is equipped with a double basin stainless steel sink with a spray nozzle attached. An automatic glass washer was purchased for use in the sinks to help wash pots.

Wayne Olson and Levi Clinton designed and built a drying rack for the washed pots. To accommodate more pots the rack can be extended to double its width. Student time slip help are hired to wash pots and meet the needs of the station.

Special circumstances this past year have mandated a new responsibility for the greenhouse technician. In the event of sudden government wide administrative leave, it is now the duty of the greenhouse technician, to check the greenhouses and plants before departing on administrative leave.

Pasteurizing and recycling the soil continues to be an ongoing task.

When Wayne Olson refurbished the porous bottom of the soil cart, a monitoring chart was created. The chart was used to record the carts temperature and help observe uniformity of soil temperature. This year the monitoring chart has been slightly modified. The newer version will be used to keep more accurate records on how much soil is being used between the *Phaseolus* group and the rest of the station. This past year, over 186 cubic yards of soil was pasteurized, of which the *Phaseolus* program used 26 cubic yards.

It was observed during soil pasteurization that a high amount of humidity is prevalent throughout the cart. The increased humidity moistens the soil and acts as a "wetting out" process. The "wetting out" process aids in seed germination and dust control when filling pots.

Currently, there is a germination study being conducted in regards to the pasteurized soil. This study began when weeds started to sprout soon after pasteurized soil was used in planting *Pisum*. So, approximately once a month 4 random samples of soil will be taken. These samples will then be watered as if they were used in planting to determine if any weed seed will germinate. If

weeds do emerge from the samples then more pasteurization time is needed.

Greenhouse 44 was modified this past year. Originally, the *Phaseolus* program part occupied the front half of greenhouse 44. We found that there were significant re-occurring pest problems with the *Phaseolus* increase material. It was thought that this was due to the foot traffic passing thru the *Phaseolus* half of the greenhouse to reach the back half of the greenhouse where miscellaneous plants were kept.

Prior to moving the *Phaseolus* program into the back half of greenhouse 44, new high intensity lights and a drip irrigation system were installed. The dirt floor was leveled and then converted to gravel. Black landscape cloth was laid down over the newly graveled floor. The landscape cloth acts as a weed barrier and facilitates cleaning.

The move and light installation gave an opportunity to try a total clean out and chamber sterilization. The internal temperature was increased to maximum temperature for nearly 3 weeks. This provided an uninhabitable environment for any greenhouse pest. Any pests remaining inside the chamber would finish its lifecycle without any host plant or food source.

Once the clean out procedure was complete, *Phaseolus* technician, Julie Thayer, began an IPM program. Natural predators were released to help combat common greenhouse pests. Predators released were *Encarsia formosa* for Greenhouse Whitefly (*Tialeurodes vaporariorum*), *Hypoaspis miles* and *Neoseiulus* or *Amblyseius cucumeris*, for Western Flower Thrip, and *Neoseiulus* or *Amblyseius fallacies* and *Phytoseiulus cersimilis* for Two Spotted Spider Mite (*Tetranychus urticae*). As a result of Julie's Integrated Pest Management program, there was only one pesticide application to the *Phaseolus* program in greenhouse 44 since the relocation. The pesticide application was necessary only as a precautionary measure.

Pest monitoring continues and has proved to be beneficial in determining the rate of infestation and overall weekly condition of each greenhouse. In 2001, Dr. Steve Clement, the station Entomologist, was called to help establish guidelines for determining pest infestation levels. In the guidelines, Level 1 represents the lowest infestation level, and Level 5 represents the highest level of pest infestation. At pest infestation Level 5 the greenhouse plants are in need of immediate attention. Dr. Clement also provided assistance in determining which infestation levels were in need of pesticide application when there were questions.

This year the greenhouse lighting was updated. The 109 B greenhouse complex was built in 1991. It was believed the current light bulbs used in these greenhouses were part of the original equipment. A light meter was used to determine if light output was at an optimal level. Random samples were taken to get an average reading of illumination. Output was found to be less than half of what it should be, resulting in illuminations as low as 32 micromoles. When replaced with brand new light bulbs, the illumination jumped as high as 199 micromoles without the lens covers on. With that new information, old light bulbs were replaced with new ones in both the east and west greenhouse of 109 B.

Understanding the greenhouse environmental control systems and their operation has steadily

been added to routine greenhouse duties. Each greenhouse was built at a different a time, so the environmental control systems vary from one another. Understanding their operation has been a great undertaking.

This past April, Jeff Bonnett, the weekend greenhouse water moved out the area. Jeff had worked for the station since January of 1999. Judy Cochran has been hired as the weekend and holiday waterer.

Committees, Training, Other Assignments

- | | |
|-----------|---|
| Jan. 9-10 | Attend seminars to maintain Certified Pesticide Applicators license.
Maintain Respirator Training and Fit Test |
| Sep. 13 | WSU Leadership Development Module (Introduction, Mission and Goals of WSU, Leadership Skills Panel, Policies, Procedures, and Records Retention). |
| Sep. 20 | WSU Leadership Development Module (Budget Process at WSU, Safety Responsibilities of the Supervisors, Return to Work Policy, Domestic Violence Awareness Training). |
| Sep. 27 | WSU Leadership Development Module (State Ethics Law, Conflicts of Interest, Public Records and Records Requests). |
| Oct. 4 | WSU Leadership Development Module (Employment Issues at WSU, Family Medical Leave Act). |
| Oct. 10 | WSU Leadership Development Module (Managing and Valuing Diversity). |
| Oct. 18 | WSU Leadership Development Module (Employee and Labor Relations). |
| Oct. 25 | WSU Leadership Development Module (Sexual Harassment Prevention). |
| Nov. 1 | WSU Leadership Development Module (Performance Planning and Evaluation). |
| Nov. 8 | WSU Leadership Development Module (EEO/AA/ADA Principles in Decision Making). |
| Nov. 15 | WSU Leadership Development Module (Decision Making Styles). |

Plans for 2002

1. Supervise and maintain chemical inventory. Continue to reduce the number of older chemicals in chemical storage.
2. Supervise and maintain the inventory stored in the potting shed. Coordinate pot washing to the needs of the technicians and curators. Store clean pots and pre-mixed soil.
3. Officially enroll and register in the WSU Leadership Development for Supervisors.
4. Join the WSU Plant Growth Facilities Advisory Committee.
5. Continue to develop greenhouse and pest monitoring program.
6. Enroll in a course at WSU.

NATIONAL FORAGE LEGUME GENETIC RESOURCE UNIT, PROSSER, WA
(S. Greene)

Activities

Our unit is involved in the maintenance, accession acquisition, evaluation and distribution of the NPGS temperate forage legume germplasm collections which contain over 11,000 accessions representing current and obsolete cultivars, landraces, wild species and genetic stocks. Additionally, we carry out research in support of our germplasm conservation objectives.

Collection Maintenance

The table below summarizes the number of accessions increased at Prosser, WA, in 2001.

Genera	Overwintered '00	Started Spring '01	Started Fall '01	Seed Rescue
Lotus	1	4		
Medicago	3	129	50	
Trifolium	52	6		20
Total:	56	139	50	20

Number of regenerations was down due to drought conditions. With the potential of water shortages on the Roza Farm we did not put out as many cages as planned, nor did we set up a full row of containerized plots.

Other activities:

- Estela Cervantes was hired as a full time permanent technician. Her duties include handling accessions that require special care, seed rescue, and maintenance of regeneration database and collection of evaluation data.
- Developed seed rescue procedures using sterile techniques. Purchased laminar flow hood, other equipment, and lab supplies to set up seed rescue lab. Rescued 20 accessions using new procedures.
- Explored the feasibility of adopting the regeneration standards suggested by Sackville- Hamilton, R. (1997). Standards for Regeneration. p. 103-108. *In* ECP/GR Report of Working Group on Forages, 6th meeting, Norway by setting up 4 cages using red and white clover, trefoil, perennial and annual medics.
- New cage frame and cover was designed. 90 new frames and covers constructed. Leaf cutter bee incubation chamber was constructed.
- Developed initial design for combination greenhouse/drying facility. Requested and was assigned WSU screenhouse # 2012. Dialoged with ARS area engineer, WSU facility manager to determine possible renovation strategy. Requested field reassignment to Singleton Headquarters Unit. Added a new cement pad to seed cleaning facilities and upgraded wiring and siding in threshing shed.
- Upgraded computer equipment, which included purchasing a bar code printer that can print plastic horticulture labels, and a Pocket PC with bar code scanner to facilitate data collection and accession tracking.

Accession Acquisition

- 2000 Kazakhstan germplasm: Completed chromosome counts, increased seed and took data on flower color and pod shape. Based on evaluation, determined taxonomic nomenclature. Organized passport data for inclusion in GRIN
- Wrote an exploration proposal for Turkmenistan. Although it was received favorably, it was not funded due to security issues. However, it will be funded at a later date.

Germplasm Evaluation

1. Verified the taxonomy on all accessions being regenerated. GRIN was updated with taxonomic changes. We also evaluated Kazakhstan germplasm (see above).

Germplasm Distribution

In 2001, we distributed the following number of seed packets: *Lotus*, 169; *Medicago*, 2075; *Trifolium*, 420. We also answered numerous requests for information.

Research Activities

Considerable attention was focused on preparing a manuscript that related morphologic and RAPD marker variation to collection sites of wild populations of red clover. This paper was submitted to *Molecular Ecology*, and is currently in the review process.

In collaboration with Dr. Alexandr Afonin, University of St. Petersburg, developed a preproposal entitled: “Development of a GIS-based Interactive Agricultural Atlas to Promote Food Security in the Former Soviet Union” for submission to the ARS-Former Soviet Union Scientific Cooperative Program. The preproposal was accepted and the ARS will be funding a visit from Russian collaborators to Prosser, WA to develop the full proposal in Feb. 2002. In collaboration with Dr. Marina Roumiantseva, and Dr. Nicolai Dzubenko, submitted a \$ 100,000 proposal entitled: “Evaluation of genetic resources as a source of salt-adapted *Rhizobium*-Legume symbioses to benefit the restoration of saline regions around the Aral Sea” to the U.S. Civilian Research & Development Foundation. This proposal was not funded.

Talks and Presentations

- | | |
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| Jan. 30 | “Apple Genetic Diversity”, Science Symposium, Davis High School, Yakima, WA. |
| Feb. 7-8 | “Correlating GIS-derived site description with germplasm variation” NPGS GIS Workshop, Fort Collins, CO. |
| Feb. 7-8 | “Developing cost-efficient GIS products to support germplasm collection in Kazakhstan” NPGS GIS Workshop, Fort Collins, CO. |
| May 16-17 | “Correspondence between GIS-Derived Site Description and Plant Germplasm”. Applications of GIS to Bioinformatics Symposium, Virginia Tech., Blacksburg, |

- Oct. 21 VA. (<http://www.vbs.vt.edu/A1GISBIO/GISBIO.html>)
Clover and Special Purpose Legume Crop Germplasm Committee- Annual Report. Charlotte, NC.
- Oct. 22 “GIS Tools and Plant Exploration: Practical Application”. C-8 Symposium- plant exploration: issues, challenges, and technology; ASA Annual Meeting, Charlotte, NC.

Travel, Invitations, Special Awards and/or Assignments

- Jan. 30. Traveled to Yakima, Washington to provide lecture on genetic diversity at Davis High School.
- Feb. 7-8 Traveled to Fort Collins, Colorado to participate in an NPGS GIS workshop. Gave two presentations.
- May. 16 – 17 Traveled to Blacksburg, Virginia to present invited paper at the Applications of GIS to Bioinformatics Symposium, (<http://www.vbs.vt.edu/A1GISBIO/GISBIO.html>)
- Oct. 21-24 Traveled to Charlotte, NC to attend CSSA Annual Meeting. Attending CSPL CGC meeting, gave invited paper at C-8 Symposium.
- Traveled to Pullman to carry out business at the WRPIS on a quarterly basis.

Committees, Other Assignments, Activities and News

- Developed and published a Unit web site: <http://www.forage.prosser.wsu.edu>
- Contributed to: Clover and Special Purpose Legume Crop Germplasm Committee Report of Germplasm Status.
- Was elected by members of the C-8 division of the Crop Science Society to be the Chair in 2003. Assumed responsibilities of Chair-elect in 2002.
- Was asked to be on the committee and agreed to review C-8 papers and identify and rank the 4 best papers published in 2000 for the Best Paper Award given at the 2001 annual meetings. Other committee members also selected the papers I ranked best.
- Continued to serve on the Crop Science Registration Subcommittee “other legumes”, chaired by Dr. Fred Muehlbauer. Reviewed approximately 20 registration manuscripts in 2001.
- Was asked to serve as a proposal reviewer for the U.S. Civilian Research & Development Foundation (CRDF). Reviewed one germplasm-related proposal this year.
- Reviewed approximately 4 manuscripts for Crop Science

Plans for 2002

The unit is planning to increase between 300-400 accessions, focusing predominately on Medicago, Trifolium and Lotus. We will continue to examine the use of containerized increases

this year as an actual seed increase. We will continue to seek adequate lab. space and set up our seed rescue lab. We will continue to develop better ways to gather and input regeneration data with the use of bar codes and a handheld pocket pc with built in scanner. We will learn the new version of GRIN and get set up so we have direct line to the Beltsville computer. Will work with Alexandr Afonin and colleagues to develop a final proposal to submit to the USDA-FSU Cooperative Research Project. The documentation projects we plan to work on in 2002 include completing a documentation and seedlot inventory upgrade of the Lotus collection. In terms of research papers, I plan to write a summary paper of the 2000 Kazakhstan collecting trip, and complete and submit a manuscript on the orchard grass work carried out with Marina Gritsenko in 1998.

NATIONAL ARID LAND PLANT GENETIC RESOURCE UNIT, PARLIER, CA (M. Jenderek, J. Serimian, C. Zenteno)

Activities

In 2001, the Parlier site processed a total of 1,441 different accessions of 34 diverse genera and 91 different species. Among the 1,441 accessions, 1006 accessions belonged to other NPGS sites (Ames, IA, Aberdeen, ID, Geneva, NY, and Pullman, WA), and 435 accessions are ascribed to the Parlier site. The back up collection for *Corylus* sp. (for Corvallis, OR) was enlarged to 149 accessions. A new Perennial Nursery with 331 plant accessions was established. The site has collected and added to the Parlier NPGS holdings 26 new germplasm accessions (2 *Agave* sp., 20 *Opuntia* sp., and 4 *Yucca* sp.). A preliminary list of descriptors was established for *Bassia* and *Atriplex* sp. and evaluation for 77 *Bassia* accessions was carried out. This was a successful year for germplasm propagation at our station.

A new Biological Science Technician was employed and a Bio. Sci. Aid for a year term appointment was recruited. A high school minority student was mentored in a summer USDA-ARS Research Apprenticeship Program.

The following infrastructure improvement projects were completed - storage shed for small equipment, installation of a motorized screen cover system on screen house #2, pavement of a parking area in front of the head house, RO system to coolers in screen house #1, installation of horizontal fans in both screen houses, and a motorized vent opening in screen house #1, enlarged space in microscope room, installed rain and valley gutters on the west side of seed preparation room, electric installation in north extension, north storage shed and the temporary lab space.

Research Activities

The first year of an experiment on establishing effective isolation structures for wind pollinated plant species was completed (model plant - *spimaau oleracea*).

Fertility evaluation for additional 10 garlic germplasm accessions was carried out and pollen viability was tested for over 100 garlic groups designated for self-pollination. Germination of garlic true seeds in 3 different temperatures, and the addition of 2 different chemical compounds was tested. However, Parlier is not the primary site for *Allium sativum* preservation, the fertility and pollen germination data are of interest to germplasm users of the species. A part of the results were presented at the Garlic Symposium in Tulsa, OK and on a Garlic Day, organized by UC Davis extension in Santa Clara, CA.

S1 progenies for selected garlic germplasm accessions were developed. This plant material will be used in a study on synteny between *Allium sativum* and *Oryza sativa*. A 2-year grant from USDA, IFAFS was awarded for this project.

Station Visitors

Feb. 23	Dr. Charles Erickson, Aberdeen, ID (cereal)
Mar. 19	Dr. Phil Simon, Madison, WI (garlic)
May 03	Dr. Charles Erickson, Aberdeen, ID (cereal)
May 25	Mr. Luis Wang, Fresno, CA (plant tissue culture)
Aug. 14	Mr. Craig Dreman, San Francisco, CA (meadofoam)
Oct. 11	Dr. Robert Kruger, Riverside, CA (site visit)
Oct. 11	Dr. Joshi Kikamura, Japan (garlic)
Oct. 16	Dr. Joseph Postman, Corvallis, OR (hazelnut)

Talks and Presentations

Mar. 24-25	"Micropropagation of Eastern Hibiscus from callus" (poster, A. J. Olney - coauthor). AgBiotech 2001 Symposium (A Central California Agricultural Biotechnology Symposium), Fisher Camp, CA.
Jul. 12	"Seed producing germplasm in garlic" (presentation, invited). The 4th Annual Garlic Field Day, UC Davis-BAREC, Santa Clara, CA.
Oct. 30 - Nov. 2	"Developing true seed in garlic" (presentation, invited), Garlic is Life Symposium & Garlic Growers Conference, Oklahoma State University Tulsa, OK.

Travel, Invitations, Special Awards and/or Assignments

Jul. 12	The 4th Annual Garlic Field Day, UC Davis-BAREC Santa Clara, CA.
Oct. 30 - Nov. 2	Garlic is Life Symposium & Garlic Growers Conference, Oklahoma State University Tulsa, OK.
Nov.10 -13	5th National Symposium, New Crops & New Uses: Strength in Diversity and CGC for New Crops, Atlanta, GA. USDA, IFASF grant awarded for 2 years for "Genomic Resources for the Asparagales". ½ funding for a summer USDA-ARS Research Apprenticeship Program for high school students.

Committees, Other Assignments, Activities and News

American Society for Horticultural Science, member
Society for In Vitro Biology, member
Association for the Advancement of industrial Crops, member
California Native Plant Society, member
Crop Germplasm Committee for New Crops, ex-officio member
Leafy Vegetable Crop Germplasm Committee, member
Root and Bulb Vegetable Crop Germplasm Committee, member
Plant Germplasm Operations Committee
W6 Technical Advisory Committee
Mentored a minority high school student in a USDA-ARS summer Research Apprenticeship Program, eight weeks

Plans for 2002

1. Structures:
The most important and at the same time dreaded plan is to obtain funds for construction of laboratory and office space, post harvest seed processing structure, and a seed storage unit. Until now, all efforts initiated were unsuccessful. In screen house #1, a bench heating system will be installed.
2. Personnel:
GRIN training for one Technician will be arranged at Beltsville and at the Parlier site. The second in seniority Technician will be additionally trained in evaluating germplasm accessions according to established descriptors.
3. Germplasm:
In preparation are transplants for regeneration of over 480 new annual accessions; in this number 400 accessions are for other than Parlier sites. About 20 *Limnanthes* and *Lesquerella* accessions will be evaluated for selected descriptors. Nursery for over 50 *Parthenium argentatum*, 8 *Hesperaloe*, and 15 *Opuntia* sp. accessions will be established. A *Simmondsia chinensis* collection of 46 accessions will be planted in the Perennial Nursery. Collection of additional *Opuntia* sp. accessions from Texas will be attempted. A draft for *Bassia* and *Atriplex* descriptors will be completed.
4. Research:
A second year of evaluation of isolation structures for wind pollinated plant species will be carried out and the pollen permeability test for a new canvas cover material will be repeated. Germination enhancement treatments for sp. seed will be tested. Studies on self-incompatibility in garlic will start.

NATIONAL ARCTIC PLANT GENETIC RESOURCE UNIT, PALMER, AK

Plant Pathology (N. Robertson)

Activities

The National Arctic Plant Germplasm Resources Unit (NAPGRU) was designated as a new unit within the USDA National Plant Germplasm System in 1998, and was part of the Western Regional Plant Introduction Station, Pullman, WA through FY 2001. The NAPGRU is now supervised by the Pacific West Area Director until a Research Leader is hired to supervise all ARS employees in Alaska. A plant pathology program was initiated in Sept. 1998, and a laboratory established at the Alaska Plant Materials Center (AKPMC) in Palmer, AK. The laboratory was moved to new facilities, Sept. 2000, to the University of Alaska-Fairbanks Experiment Station in Palmer. The NAPGRU curator's facilities and plant germplasm collection remain at the AKPMC. This report will outline the research activities and accomplishments of the plant pathology program for 2001.

Research Activities

Surveyed plants in the greenhouse and field for plant pathogens that were included in the NAPGRU at the AKPMC site; selected plants were assayed for viral infections in the laboratory. No plant pathogens were isolated from the plants.

Diseased *Pyrola asarifolia* (wintergreen) and *Lupinus nootkatensis* (lupine) plants reappeared in the Hatcher Pass area. I discovered the diseases in 1999, and have continued to study both plants on-site and in the laboratory/greenhouse. In 2001, on-site studies were hampered by road construction and rock slides. Wintergreen plants continued to have yellow mosaic leaves associated with two unique proteins thought to be viral coat proteins. For the first time, similar plants were found about 60 miles north of Hatcher Pass. Lupine plants infected with a virus belonging to the *Tombusviridae* family were still confined along stream banks in Hatcher Pass. Viral particles that have been isolated from these plants have been characterized to contain icosahedral particles with a coat protein about 40kDa and a ssRNA genome about 4.3Kb. Double-stranded RNA assays and genomic sequenced fragments suggest that it is a carmovirus. Seed transmission studies confirmed that the virus is probably not seed transmitted. For the first time, the virus was successfully mechanically transmitted to 15 plants that included several exotic lupine species.

Barley yellow streak mosaic virus (BaYSMV) is now maintained in the greenhouse and isolated for characterization studies. BaYSMV studies were initiated into my research program in 1999 after I found it in barley on the UAF Experiment Station in Fairbanks. In 2000, the brown wheat mite, *Petrobia latens*, was found for the first time in Alaska. This mite is the only vector and known natural mode of transmission for BaYSMV. In 2001, I detected the mite in Fairbanks, Delta Junction, and Palmer. Caged mite/BaYSMV transmission studies are now being conducted.

Barley yellow dwarf virus (BYDV) was detected for the first time in the Matanuska farming

region in 2001. Several fields of barley had over 50 percent of the plants with abnormal leaf yellowing and some stunting. PCR assays specific for BYDV determined that the plants were infected with the virus.

Several native larkspur plants, *Delphinium glaucum*, growing at the Georgeson Botanical Garden in Fairbanks had previously been determined to be infected by a virus. In 2001, symptoms reappeared and viral particles were observed from leaf sap. Based upon particle morphology and coat protein size, the isolated virus was thought to belong to the *Potyviridae* family, but after negative results from PCR and ELISA assays specifically for potyviruses, its identity was questionable. A double-stranded RNA profile from infected leaves now suggests that the virus isolated from larkspur plants could belong to the *Closteroviridae* family.

Another native plant, *Streptopus amplexifolius* (twisted-stalk) was found to contain a virus in 2001. Plants exhibiting parallel streaks and dashes on the leaves were collected from Denali State Park, and about 50 miles southwest near Skwentna. Isolated virus particles were flexuous rods that had an apparent coat protein about 35kDa. This is the first report of a virus found in *S. amplexifolius*.

Studies on the development of an effective monocot gene expression vector were conducted using modified foxtail mosaic virus constructs. A foreign gene was successfully inserted, transcripts synthesized, and systemic viral movement obtained in barley seedlings. However, no foreign gene expression (protein product) was detected.

Talks and Presentations

- Apr. 5 Presented “Plant Viruses in Alaska, 2000” at the Alaska Rare Plant Forum, Anchorage, AK
- Aug. 24-25 Presented “Alaskan native larkspur infected with a plant virus” at the annual American Phytopathology Society meeting in Salt Lake City, UT

Travel, Invitations, Special Awards and/or Assignments

- Feb. 21-22 Attended the 20th Alaska Greenhouse & Nursery Conference, Girdwood, AK
- Apr. 5-6 Attended the Alaska Rare Plant Forum and presented a paper, Anchorage, AK
- June-July Funding was partially provided for a high school student to participate in the Research Apprentice Program for eight weeks in the plant pathology laboratory
- Mar. 7 Attended the 2001 Alaska Potato Growers Conference, Wasilla, AK
- Jun. 1-3 Participated in Introduction to Moss Genera Workshop (by W. B. Schofield), Anchorage, AK
- Jun. 7-8, Traveled to Delta Junction and Fairbanks for plant disease surveys and to use UAF
& 19-20 electron microscopy facilities
- Jun. 21-25 Traveled to Madison, WI to attend the American Society for Virology annual

- meeting.
- Jun. 29- 30 Participated in Willow Taxonomy Workshop (by G. Argus), Anchorage, AK
- Aug. 7-9 Traveled to Delta Junction and Fairbanks for plant disease surveys and EM studies
- Aug. 24-29 Traveled to Salt Lake City, UT to participate in the American Phytopathological Society annual meeting, presented a paper, and attended short course: Catching Up on Mycology

Committees, Other Assignments, Activities, and News

Affiliate Associate Professor of Plant Pathology, University of Alaska-Fairbanks
Member, Search Committee for selection of a tenure track Assistant Professor of Science, Matanuska-Susitna College, 2001
Member, APS committee, Plant Pathogen and Disease Detection, chair for 2002
Reviewed: 1) Binational Agricultural Research and Development Fund (BARD) research proposal; 2) Wheat streak mosaic virus by R. French and D. C. Stenger, for Virus Diseases of Poaceae (book in press); 3) Two "Disease Notes" and one manuscript for the journal, Plant Disease
Foxtail mosaic virus clones were sent to scientists in Australia, France, and Germany with an ARS Material Transfer Agreement
Constructed small greenhouse for summer use
Planned renovation of several rooms on the Experiment Station for installation of plant growth chambers and equipment for a pot/tray washing room and soil potting.

Plans for 2002

Research

1. Survey selected crops and native plants in Alaska for plant pathogens
2. Continue studies on the biology and characterization of the following plant viruses and their associated plant host/vector:
 - a) carmovirus/*L. nootkatensis*
 - b) BaYSMV/barley/mite
 - c) BYDV/barley
 - d) carlavirus (?)/*Delphinium glaucum*
 - e) potyvirus (?)/*Streptopus amplexifolius*
 - f) unknown agent/ *Pyrola asarifolia*

Facilities

1. Continue facility renovation (in collaboration with UAF) for installation of growth chambers and soil/potting and wash room.
-

ARCTIC GERMPLASM (D. Ianson)

Activities

Germplasm Activities

The 2001 season was one in which we harvested seed from much of what was planted in 2000. The spring of 2001 also mark the transference of *Rheum rhabarbarum* from WRPIS in Pullman to Palmer. We collected 75 accessions from Pullman (April 2001) and planted them in the greenhouse. In June, 53 accessions were transplanted into the field and 22 did not survive the transference and transplantation. I feel that if we can re-acquire missing accessions from Pullman later in the season and direct transplant them into the field we will have much better survival. We experienced one very big problem with the *Rheum* accessions, that being fungus gnats which came in and decimated those plants growing in the greenhouse. We instituted an IPM program but some of the smaller root pieces did not survive.

The 2001 season also marked the field transplanting of the bulk of the accessions transferred from WRPIS. We laid out 6' by 8' wetland beds for much of the *Juncus* (27 taxa), *Carex* (73 taxa).

We also obtained 450 accessions of alpine plants from southwest China from the Alaska Rock Garden Society. These are still being catalogued as far as passport data into our system.

Growout Activities

We transplanted *Brassica oleraceae* var. *botrytis* (Cauliflower) from the NE-9 in Geneva, New York for grow out under Alaskan conditions. This year we did not get the seed production that we had in previous years. Only three of the 10 accessions produced seed before killing frost hit.

We also received *Angelica atropurpurea*, *Zea mays*, and *Spinacia oleraceae* seed from NC7 for grow out test in Alaska. All were started in the greenhouse in January and February. The *Angelica* died in the greenhouse from rot. The *Zea* and *Spinacea* were transplanted into IRT fabric in early June. At transplant they had good vigor but transplanting seemed to shock them in a way they never recovered.

The *Schizandra chinensis* seeds sent to us from the NCR in Corvallis continued to germinate 18 months after first stratified and brought out of the cold. They grew to well over 4 feet tall and have shut down for the winter.

The *Lupinus* accessions sent to us from WRPIS for trial responded in various ways and the data is forthcoming to Claire Coyne. The accession that did not do well at the NAPGRU was *Lupinus sericeus* PI 504378.

Research Activities

We also set-up an experiment in which we transplanted taxa of the following genera: *Carex*, *Festuca*, *Poa*, *Polemonium*, *Scirpus*, *Spartina*, and *Calamagrostis* either into specially designed and portable miniature wetland beds or into 6" round pots. The above taxa were split up; and 75% of each accession placed in the portable bed. The remaining 25 % of each accession were left to overwinter in the greenhouse (4 - 10 C). The results of this experiment seem to indicate that when the wetland beds are sheltered that most of the plants survived the winter quite well and came back quite healthy.

Talks and Presentations

Jun. 26-28 Presented annual report of the NAPGRU to the W6 and the PGOC in Fort Collins CO.

Aug. 27-29 Presented the NAPGRU, our collection and maintenance efforts and our research to the 4th Conference of the Circumpolar Agricultural Association in Akureyri, Iceland.

Travel, Invitations, Special Awards and/or Assignments

Asked to serve on panel to look at monitoring invasive and noxious weeds in Alaska.

Committees, Other Assignments, Activities and News

Chairman of the Plant Germplasm Operations Committee subcommittee on transfer of germplasm between stations.

Given tours at the National Arctic Plant Germplasm Resources Unit

Plans for 2002

Travel to WRPIS and obtain crown pieces of the accessions that succumbed to fungus gnats in 2001. The trip will be scheduled for mid to late May and the crowns will go directly into the field instead of the greenhouse

Finish transplanting of wetland accessions in the lathe house and the greenhouse into our wetland beds.

Contract out the sewing of 50 to 75 pollen proof tents and frames to cover the wetland beds.

Finish putting in the underground wetland bed watering system so we can control the flooding level and frequency of the wetland beds.

A number of collections of *Oplopanax horridum* germplasm (both seed and cuttings). I am going to setup to tissue culture this plant, as the seed dormancy still proves to be very tough to overcome.

O. horridum is potentially an extremely valuable medicinal plant for the Alaskan economy.

It's chemistry is much the same as *Panax ginseng*, and it is red listed in China.

There is currently 55,000 acres in Alaska, but the USFS is debating whether to red list it on Forest Service land (for fear it will be "wildcrafted" to dangerously low levels).

Increase the number of *Rheum* accessions at the Palmer site.

Collections of wetland accessions from Alaska

Planting and seed increase of the China alpine accessions we currently have

Continue to update the infrastructure of the site in order to produce seed and maintain the germplasm assigned to us as best we can.

Finish putting together the Circumpolar Advisory committee

Get the NAPGRU OSHA compliant (a task being undertaken by the entire AKPMC)

Move the NAPGRU to Trunk road in September
